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5 handed to Mr. L. D. Huntington.

4 additional to F. J. Amisden, Feb. 24.

**Transactions**

Vol 24-28

American**Fisheries Society**

...

1895-1897

138

TRANSACTIONS

OF THE

American Fisheries Society.  
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TWENTY-FOURTH ANNUAL MEETING.

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Held in New York,

Wednesday and Thursday, June 12th and 13th, 1895.

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NEW YORK:  
THOS. HUMPHREY, PRINTER, 36 CANAL STREET.  
1896.

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## OFFICERS FOR 1895-'96.

PRESIDENT, L. D. HUNTINGTON ..... *New Rochelle, N. Y.*

VICE-PRESIDENT, CALVERT SPENSLEY. *Mineral Point, Wis.*

TREASURER, FRANK J. AMSDEN.....*Rochester, N. Y.*

REC. SEC'Y, TARLETON H. BEAN, } *Battery Park Aquarium,*  
 } *New York.*

COR. SEC'Y, H. B. MANSFIELD, U. S. N.....*Brooklyn, N. Y.*

## EXECUTIVE COMMITTEE.

HENRY C. FORD,..... 1823 Vine St., Philadelphia, Pa.

H. P. FROTHINGHAM.....*Mt. Arlington, N. J.*

HERSCHEL WHITAKER ..... *Detroit, Mich.*

EDWARD P. DOYLE . . . . . *Port Richmond, S. I., N. Y.*

W. L. MAY ..... *Omaha, Neb.*

W. de C. RAVENEL, U. S. Fish Com.....*Washington, D. C.*

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MINUTES  
OF THE  
TWENTY-FOURTH ANNUAL MEETING  
OF THE  
AMERICAN FISHERIES SOCIETY,  
HELD IN  
NEW YORK AQUARIUM,  
Castle Garden, N. Y.,

ON WEDNESDAY, JUNE 12TH, 1895.

The following members were present on roll call:

W. L. May,	Omaha, Nebraska.
Herschel Whitaker,	Detroit, Michigan.
Fred. Mather,	Cold Spring Harbor, N. Y.
H. C. Ford,	Philadelphia, Pa.
Frank J. Amsden,	Rochester, N. Y.
H. B. Mansfield,	U. S. Navy.
William H. Bowman,	Rochester, N. Y.
David G. Hackney,	Fort Plain, N. Y.
Robert Hamilton,	Cambridge.
Dr. Bushrod W. James,	Philadelphia, Pa.
Tarleton H. Bean,	New York.
W. deC. Ravenel,	Washington, D. C.
J. J. Stranahan,	Put-in-Bay, Ohio.

John W. Titcomb,	St. Johnsbury, Vermont,
J. W. Hoxie,	Carolina, R. I.
H. W. Davis,	Grand Rapids, Michigan.
L. D. Huntington,	New York.
Edward P. Doyle,	New York.
A. N. Cheney,	Glens Falls, N. Y.

President W. L. May, of Omaha, Nebraska, presided.

After the roll call, the President announced that in order to facilitate business he would appoint Committees on Nominations, Auditing the accounts of the Treasurer, and on time and place of next meeting. The Committees appointed were as follows :

*Committee on Auditing accounts of Treasurer—*

Henry C. Ford,	Philadelphia, Pa.
H. W. Davis,	Grand Rapids, Michigan.
Henry H. Lyman,	Oswego, N. Y.

*Committee on Nominations—*

Herschel Whitaker,	Detroit, Michigan.
W. H. Bowman,	Rochester, N. Y.
G. F. Peabody,	Appleton, Wisconsin.
H. B. Mansfield,	New York.
H. C. Ford,	Pennsylvania.

The *Committee on location of place of next meeting* was as follows :

B. H. Davis,	Palmyra, N. Y.
James A. Dale,	York, Pa.
J. W. Hoxie,	R. I.

The following gentlemen were elected to membership in the Society :

N. R. Buller,	Carolina, R. I.
W. C. Clark,	Newark, N. J.
D. P. Corwin,	Pittsburg, Pa.
Dr. Jas. A. Dale,	York, Pa.
B. H. Davis,	Palmyra, N. Y.
H. B. Frothingham,	Mt. Arlington, N. J.
Monroe A. Green,	Rochester, N. Y.
C. E. Griffith,	Staten Island, N. Y.
G. Hansen,	Osceola, Wis.
Hiram F. Hurlbut,	Lynn, Mass.
A. A. Hynemann,	55 W. 33d St., New York.
G. E. Jennings,	317 Broadway, New York.
Dr. O. L. Jones,	30 W. 35th St., New York.
J. Harrington Keene,	Greenwich, N. Y.
Henry H. Lyman,	Oswego, N. Y.
Dr. Justus O'Hage,	St. Paul, Minn.
Parker Page,	West Summit, N. J.
Geo. F. Peabody,	Appleton, Wis.
G. Pfeiffer, Jr.,	Camden, N. J.
E. T. Rowinville,	East Freetown, Mass.
Edward Thompson,	Northport, N. Y.
W. R. Weed,	Potsdam, N. Y.

The President then called for a list of the papers to be offered at the meeting. The following papers were presented to be read:

1. *The Influence of Railroads on Fish Culture.* Fred. Mather.
2. *The Decadence of our Trout Streams.* J. S. Van Cleef.
3. *Impoverishment of the Food Fish Industries.* Dr. Bushrod W. James.

4. *The Distribution of the Trout Family.* W. D. Tomlin.
5. *Epidemic among Trout in Nebraska.* M. E. O'Brien.
6. *Observations on the Moral Phases of Modern Fish Culture.* Herschel Whitaker.
7. *The Work of the United States Fish Commission.* Tarleton H. Bean.
8. *A New Hatchery.* Herschel Whitaker.
9. *The Artificial Hatching of White Fish and Brook Trout, and the relations of planting to results.* Seymour Bower.
10. *The work of the State Association for the protection of Fish and Game.* F. J. Amsden.
11. *Disease of Trout in Caledonia Creek.* Prof. C. W. Dodge.

May 20  
and 21

The Committee on time and place of next meeting presented its report, and recommended that New York City be selected as the place of the twenty-fifth meeting of the Society, the time to be the third Wednesday and Thursday of May, 1896. On motion the report was received and adopted. On motion the Society took a recess until one o'clock for lunch.

When the Society reconvened at one o'clock the President declared the first thing in order was the presentation of the reports of Committees. The Committee on Nominations recommended the following officers for the ensuing year:

- L. D. Huntington, New York, *President*.  
C. Spensley, Wisconsin, *Vice-President*.

T. H. Bean, New York, *Recording Secretary*.  
 F. J. Amsden, Rochester, New York, *Treasurer*.  
 H. B. Mansfield, Brooklyn, *Cor. Secretary*.

*Executive Committee—*

Henry C. Ford, Philadelphia, Pa.  
 H. P. Frothingham, N. J.  
 Herschel Whitaker, Detroit, Michigan.  
 Edward P. Doyle, New York.  
 W. L. May, Omaha, Nebraska.  
 W. deC. Ravenel, Washington, D. C.

The report of the Committee was received and on motion approved, and the Secretary was directed to cast one ballot for each of the officers named in the report. The Secretary cast the ballots as directed, and the officers were declared elected.

The Committee on auditing the accounts of the Treasurer presented their report which, upon motion, was approved as read.

Mr. Bowman, of New York, offered the following resolution which, upon motion, was adopted :

*Resolved*, That a Committee of Five, consisting of one Commissioner from each of five States, be appointed to secure, if possible, uniformity of legislation for the protection and preservation of Fish and Game in the several States in the Union.

Mr. Bowman offered another resolution which, upon motion, was adopted :

*Whereas*, it is conceded by all parties, both commercial fishermen and others, that in the inland waters of the different States as well as in the Great Lakes, so called, the supply of food fish is decreasing annually, and that in some waters the supply has entirely disappeared.

*Therefore, Resolved*, that it is the unanimous opinion of this Society that stringent laws should be prepared by the legislatures of the several States to prevent the pollution of streams, to make a close season for all fish during their spawning seasons, and to prevent the taking and sale of fish until they have reached a proper size and age. That the size of meshes of all nets should be regulated. That such protection should be given by law that the full efforts of artificial propagation can be realized.

W. L. Powell, of Pa., offered the following resolution which, upon motion, was adopted :

*Resolved*, that the Governors of the several States, by virtue of their positions, be honorary members of the Society.

The Committee on Nominations then made a further report which, upon motion, was adopted. The report was as follows :

The committee recommend that the style and character of the report of our Transactions be changed, and that hereafter the report shall show in the natural order in which they occur the transactions of the Society, the discussion to follow each paper as it occurred, and that the Transactions be published within 60 days after the meeting.

We further recommend that the Rec. Sec'y be directed to notify each member of the Society of the date of the next meeting a month before the same shall take place, and that a copy of Transactions be mailed to each honorary member of the Society. That he also be requested at the same time to ask members



to contribute papers to be read at the following meeting, and that the titles of such papers be sent him.

Respectfully submitted,

Herschel Whitaker,  
H. B. Mansfield,  
Geo. F. Peabody,  
Henry C. Ford,  
Wm. H. Bowman.

Mr. Huntington, of New York, presented the following resolution which, upon motion, was adopted:

*Resolved*, that it is the sense of this Society that no fish or fry should be distributed at public expense for private waters.

Dr. Bean, of the United States Fish Commission, seconded the resolution and stated that the States now had regulations against such private distribution of fry, but that the United States still granted free fish for private waters, from which the public can derive no benefit.

The reading of the papers then began and continued until six o'clock P. M., and a resolution was adopted providing for a recess until ten o'clock the next day.

Minutes of adjourned meeting of the American Fisheries Society, held Thursday June 13th, 1895, on board the steamboat "Sam Sloan."

All the delegates in attendance at the conference were present; President W. L. May in the chair.

Mr. L. D. Huntington, of New York, offered the following resolution which, upon motion, was adopted.

*Resolved*, That the Secretary of this Society enter upon its minutes an expression of the hearty gratitude

of its members for the magnificent entertainment provided for them by the New York State Commissioners of Fisheries, Game and Forests;

*And be it further Resolved*, that there be entered the special thanks of this Society to the Hon. John H. Starin, through whose courtesy the Commissioners of Fisheries, Game and Forests were enabled to provide so commodious and elegant a steamboat;

*And be it further Resolved*, that the thanks of the Society be extended to the Hon. Edward Einstein, President of the Department of Docks, for the privilege of landing at Pier A, Battery, and the further thanks of the Society to the Department of Public Parks of the City of New York, through whose courtesy the Society was permitted to use the Aquarium for the purposes of their annual session.

Mr. Huntington also introduced the following resolution which, upon motion, was adopted:

*Resolved*, That the thanks of this Society be extended to the outgoing Officers of the Association for the services rendered by them to the Society during the past year.

Mr. Herschel Whitaker, of Detroit, Michigan, introduced the following resolution which, upon motion, was adopted:

*Resolved*, That the thanks of this Society be extended to Mr. Thompson and the Northport Oyster Company for the very kind courtesy they have extended to us in the use of the steamer "Mystery" for the purpose of explaining the cultivation of shellfish.

A resolution was then introduced by Mr. Whitaker, and passed, making J. Sterling Morton, a member of the Cabinet, Washington, D. C., an honorary member of the Society.

The following resolution was offered by Mr. Herschel Whitaker and, on motion, was adopted.

*Resolved*, That the American Fisheries Society desires to congratulate the Board of Parks of the City of New York upon the establishment of a free public Aquarium at Castle Garden. The installation of such an Aquarium reflects credit upon the city which has promoted it, and will serve to entertain the people with a continuous and pleasing exhibit of the common and rare forms of the fauna and flora of her waters, and the student will be afforded an opportunity for scientific observation furnished nowhere else in America.

We further desire to congratulate the Board in securing the services of Dr. Tarleton H. Bean as Director, who brings to this particular work such ripe experience and broad information as to insure the success of the enterprise.

Mr. Mather then said that recently he saw in the Fishing Gazette that Mr. Samuel Wilmot, with whom he had been acquainted for many years, had been retired on half pay as a reward for faithful and continuous service. Mr. Mather suggested that, as this was commonly done in Canada and Great Britain, it might be appropriate for the Fisheries Society to recommend that some sort of custom of this kind be resorted to in this country as a reward for long and faithful service.

On motion, the Society adjourned.

EDWARD P. DOYLE,

*Secretary.*

## REPORT OF RECORDING SECRETARY.

## GENTLEMEN :

A plan was adopted at the meeting at Philadelphia last year by which the membership, it was thought, of the American Fisheries Society could be very largely increased. The Secretary was associated with the Committee, and an attempt was to be made to get into the membership of the Society very prominent men interested in the preservation and propagation of fish and game in the United States. The great pressure of business, however, on the part of the Recording Secretary, prevented him from carrying out the object of the resolution, and the result is that, although several thousand circulars were sent out, no attempt was made to follow up the first circular, and an increase of fifteen or twenty members was all that the Society secured during the past year. This fact, however, does not affect the belief of the Secretary that the membership of the Society could be very easily increased to several thousand members, and made one of the most important associations of its kind in the world. Whenever a man, interested in the object of the association is approached properly, his name can be secured, and a thorough and systematic canvass of fish and game people of the United States would certainly secure an extremely large and valuable membership. The Society then would become of great importance in recommending and determining legislation, and in furthering the investigations of fish and game. I would suggest that some Committee of the members, composed of men who have leisure and who are enthusiastic for the protection of fish and game, be formed, and that this Committee be authorized to employ some-

body and cause to be made a thorough canvass of the United States, using as a basis the present members of the Fisheries Society. In this way, I believe the membership could be swelled to three or four thousand members. The membership of the Society is now about 225. Nearly all the Fish Commissioners of the United States are members, and a number of prominent Fish Culturists, but the membership, of course, is not what it should be. I hope that this matter will receive the careful consideration of the Society at this meeting, and that every endeavor will be made to take the necessary steps to secure a larger and more influential membership.

Very respectfully yours,

EDWARD P. DOYLE.

## TREASURER'S REPORT.

FRANK J. AMSDEN,  
IN ACCOUNT WITH  
AMERICAN FISHERIES SOCIETY.

DR.

To amount received from Dr. R.

O. Sweeny, Sr..... \$80.65

Membership dues received to June

12th, 1895..... 111.00

\$191.65

CR.

Bill for stationery..... \$16.25

" " stenography..... 15.44

" " "..... 4.00

" " membership book..... 11.25

" " part payment on printing

Transactions, 1894..... 80.65

Cash on hand..... 64.06

\$191.65

FRANK J. AMSDEN,

*Treasurer.*

NEW YORK, June 12th, 1895.

Approved,

HENRY C. FORD,

H. W. DAVIS,

H. H. LYMAN,

*Auditing Committee.*

## THE INFLUENCE OF RAILROADS ON FISH CULTURE.

---

READ BEFORE THE AMERICAN FISHERIES SOCIETY, BY  
FRED MATHER, COLD SPRING HARBOR, N. Y.

---

The continual extension of railroads has been an important factor in stimulating fish culture, and has had a most important bearing on it that is worth considering. When I am asked why shad are not cheaper, now that so many millions of eggs are taken from fish caught for market and are hatched and added to the natural product of the rivers, I answer, "railroads." If the question refers to the price of oysters, lobsters or the fresh-water fishes of the Great Lakes, the same answer is returned.

Forty years ago the Hudson River furnished all the shad for New York City and for a district included in two strips thirty miles back from each bank of the river as far north as Troy. Farmers drove in to the fishing grounds and bought shad to salt for winter use and in the height of the season they could be bought at the nets for from three to five dollars per hundred. In Albany they retailed at two for a quarter of a dollar, and some times for less. Lobsters were retailed at about five cents per pound and were seldom seen under four pounds weight, oftener six to eight pounds. Before the building of the Boston and Albany Railroad teams came through to Albany from Boston, when sleighing was good, loaded with boxes of fresh codfish,

haddock, pollock and kegs of opened oysters. The latter were in quart, two quart and gallon sizes. The Hudson River Railroad was not built and the only source of supply of sea-food in winter was from Boston. In summer the steamboats brought some shell oysters to Albany, but the demand was light and the shipments were not as prompt as now and I often heard it said that we never got good oysters in Albany! To-day they can be had in Omaha, owing to fast trains, prompt express service and the use of ice, for it must be remembered that there were no express companies in those days, and the great New York Central Railroad did not exist as a continuous line. From Albany to Rochester there were three railways; the Albany and Schenectady, the Schenectady and Syracuse, and the Syracuse and Rochester via Auburn and Canandaigua. These roads did not sell tickets, nor check baggage, beyond their own lines, and if passengers were delayed by stops to transfer and re-check baggage, freight was sure of long delays. No wonder, then, that the inland towns of the State of New York in those days never saw an oyster in the shell, nor a shad. Ice was then a luxury and we only got a few lobsters because they spoiled so quickly that it did not pay to risk large shipments. Under these circumstances it is plain that shad, lobsters and sea fish did not get far beyond Albany and Troy, the head of navigation on the Hudson.

In boyhood days, forty-five to fifty years ago, I did not see either hard or soft crabs in Albany, but my father was part owner in and agent for the Eckford line of barges engaged in freighting between Albany and New York, before canal boats were towed down the river, and my main desire for a trip to the great city was to buy boiled hard crabs along the dock for a cent a piece and go down the pier and eat them, regardless of smeared face and fingers. Now soft crabs are com-



mon in Chicago; packed in sea weed and kept cool they are whirled through in good shape.

In the early days of which I have spoken and up to twenty years ago no shad came to New York from Florida, nor even from North Carolina, where some of the finest come from to-day, and the citizens of the great metropolis waited for the first shad to be taken in New York Bay. This was an event in the year that was heralded far and wide and hotels bid high for the first fish, as much as twenty-five dollars, having frequently been paid for the honor of serving the first shad of the season by the Astor House and other hotels. Now that Florida begins to send shad in mid-winter, the strife for the first "North River" shad is ended.

Having glanced at the different conditions of rail-roading some decades ago and noted the effect upon the fish markets of inland towns, let us see how the changed conditions affect fish culture, which only began operations on a large scale well within twenty years. The pioneers in fish culture fondly expected to make fish cheaper for the masses. We expected to multiply certain species to such an extent that the market prices would be perceptibly lowered, and it is on record that the shad fishermen of Holyoke and South Hadley Falls, Mass., rebelled at the first efforts at shad hatching there by the late Seth Green because he said that he could "make shad cheap." He meant that they would be made plenty, and merely used the wrong word to the fishermen. We have increased the yield of shad in the Hudson, the Delaware and in other rivers farther south, but this increase of supply has been met by an increased demand that has kept prices up to, and even beyond, the old standards, and the extension of railways and the improved express facilities have made increased demands upon the shad fisheries that has kept, and will keep, the prices up,

and perhaps increase them notwithstanding the increased production.

In this paper I have chosen to take the shad as an illustration of the effect that the railroads have had on fish culture in America, but the same line of argument is applicable to the white fish of the Great Lakes, which now reaches a hundred tables where it only fed one a quarter of a century ago. The oyster is more subject to an increased consumption by the extension of railroads than either the shad or the white fish, for it not only has a longer "season" but is not as perishable as the fish, and by the use of ice is now found on the "half shell" in most small towns, while in tins, both raw and cooked, it is a visitor to many mining camps.

But to return to the shad. The increase of population, and of fishermen with improved appliances along the Hudson River, would have exhausted the supply of shad without the help of railroads twenty years ago but for the aid of the fish culturist. The annual catch had been falling off for some years before the work of shad hatching was begun and continued to fall off for several years after, for the first work was done on a small scale. We know this in a general way by reports of the fishermen, for there had been no attempt to gather the fishing statistics until 1880; but both fishermen and marketmen from Troy to New York City, agreed that the supply had gradually fallen off, until many fishermen declared that it did not pay to wet their nets.

The work of shad hatching on the Hudson River was begun in a small way by the State Fish Commissioner in 1868, near Coeymans.

The next year work was not begun until the first day of June (second report, page 4), about a month late, and continued until July 13th. The report says: "Only 15,000,000 of shad were hatched in place of

300,000,000 as could doubtless have been done, had proper legislation been had." In 1870, there were 2,604,000 shad fry planted (see report for that year, page 4).

This, judging by the plants afterward made, was an average year and it is possible that there was a typographical error in the figures for 1869. But, whatever may have been the number planted each year since the good work began it is certain that each young shad artificially hatched would never have seen daylight but for the aid of the fish culturist, for the eggs obtained were from fish caught for market and would have been wasted entirely, as they were too ripe to be eaten as "roe" for when within a week of maturity the ovarian sac is almost purple with the distended veins and not at all tempting as food, besides being very tender to handle, for the eggs are ready to drop apart.

This extra supply of young shad, preserved from danger during the egg and embryo stage and let loose at the time when ready to take food, supplements and reinforces the natural hatch in the river, which has gradually grown less each year, because of the increase of fishermen with improved appliances of capture to supply the increased demand occasioned by the extension of railroads.

Looked at in this light it will be seen that the natural hatch in the river must decrease in proportion to the number of fish caught, and only artificial propagation has kept the shad fisheries of the Northern States up to their former standard, and now that the southern rivers are beginning to feel the drain, they will soon have to look to shad culture to keep up their stock, or see it dwindle into next to nothing as the shad catch has done in the Connecticut River. This river furnishes a case in point. Its shad fisheries, once so famous, have fallen off until they are hardly sufficient

for home consumption since hatching was discontinued at South Hadley Falls. In 1880 the catch of shad in the Connecticut was 268,608, or about equal to 1,074,432 pounds, with a value of \$53,721. In 1889 the catch of the whole State of Connecticut, including the Housatonic, Connecticut and Thames Rivers was less than one-third of the catch of 1880, the official figures for the three rivers being 48,963 shad, weighing 195,852 pounds, and worth \$16,580.

These figures for two different years would mean little did we not know that the falling off had been gradual, and that the catch has fluctuated with a downward tendency for the past six seasons.

The shad in the Hudson have been enabled to stand the drain caused by an increased local population and the shipments by rail by two factors; artificial fish culture and the newly worked southern rivers. I say "newly worked" because it is only a few years since the northern markets have taken great quantities of shad from the south. Ten years ago New York City was forced to look beyond the Carolinas for early shad, and Florida began to get her fish to the great market even as early as January; and how long these rivers will stand the increased fishing without crying for aid from the fish culturists remains to be seen. At present the hatching of shad is mainly done on the Hudson, the Delaware, Chesapeake Bay and the Potomac. Some work has been done on Virginia rivers and in North Carolina, but the work of the U. S. F. C., near Havre de Grace, where the Susquehanna loses itself in Chesapeake Bay, has been one of the most important stations. Last year the State of New York received over seven millions of shad fry from that place for planting in the Hudson, in addition to what hatching was done on that river.

According to the census of 1880 the catch of shad in the Hudson was 683,400 fish, which at an average of four pounds each would be 2,733,600 lbs., valued at \$136,680, at wholesale. While I have not the figures at hand for any of the succeeding years I am informed by the fishermen that the river has more than held its own in the past fifteen years.

From the above statements it seems plain that while the fish culturist has been striving to increase the food supply, and possibly cheapen it, he has merely been successful in keeping the supply up to the increased demand, and the railroads have prevented any decrease in prices by taking all surplus above the local demand far inland, and thereby bringing to people distant from the fisheries delicious and wholesome food which has been produced by the fish culturist.

Last year Mr. Charles Hallock read a very interesting paper before this society, entitled "When shad were a penny a piece," in which he stated that "Connecticut shad in barrels were first advertised in Boston in 1736, though they were current in river towns for at least three years previous at one penny a piece. By 1773 prices had advanced to two or three pence." This was caused by lack of transportation to inland towns, and no matter how many shad we may produce, those prices will not be heard again, nor will the markets be glutted to the extent of lowering present prices, unless for an occasional day or two when the catch has been much larger than usual.

The extension of railroads will always drain the fisheries, which are limited in production, especially in the fresh waters. The shad only feed in fresh water during their first year of life and afterward get their growth at sea, but the pasturage for young shad, to borrow a word from the herdsman, is limited by the amount of food such as cyclops, copepoda, daphnia,

etc., which are in turn limited by other causes. Therefore there is a natural limit to the capacity of every stream to produce fish, but that limit in our shad rivers and in our lakes has not even been approached by our labors in fish culture.

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### DISCUSSION ON THE PAPER OF MR. MATHER.

Dr. Bean: "I only want to call your attention to another epoch in the history of the introduction of the shad into rivers in which they were not native, in connection with the State of California. In 1872, Seth Green, I believe, carried the first young shad to California. In 1876 the first so called large shipment, consisting of 130,000 fry, was deposited by Mr. Frank Clark and myself in the Sacramento. After that time a few additional plants were made; the U. S. Commission carrying at most about two millions of eggs, which were hatched on the way, bringing the total of plants of shad in California to not more than five millions of fry.

"Speaking of the time when shad were a penny apiece, which I suppose was the English penny, equal to two cents in our money, that day was a parallel of the present time in California, for shad are now selling at wholesale at from one cent to two cents per pound in San Francisco. It struck me as a very interesting coincidence, and it is an illustration of what can be done by planting. The introduction of the shad on the Pacific coast stands out to-day as perhaps one of the most forcible illustrations of what artificial methods can do in our waters."

"The striped bass in California are now as plentiful as the shad, as a result of carrying them from

New York waters, and other eastern localities, ten or twelve years ago."

M. Goraud: "Is there not a proposition to exclude California shad from the New York market?"

Dr. Bean: "I dont know whether the California shad could be sold in the New York market, when they have been selling in the Chesapeake basin as low as six dollars per hundred, six cents apiece for large shad. Surely California could not compete, because the transportation would cost double as much as the shad."

Mr. Mather: "I have heard from several correspondents that shad weighing fourteen to sixteen pounds are common in the markets."

Dr. Bean: "There is a reason for the shad being cheap on the Pacific coast. The shad in California do not go to sea. They remain the year round in the bays or in brackish water near the river mouths. They are kept from going to sea by a wall of cold water and as a consequence they can be got in every month of the year. They have gradually spread into the estuaries along the coast until they are now known in southern Alaska."

Mr. Goraud: "Isn't the so called limit of size of the shad in eastern waters due to their excessive capture, which operates to prevent the growth of the fish? It has been said that in our fore-father's time, when shad were a penny a piece they grew to large size."

Dr. Bean: "Within the last five years two shad weighing about thirteen pounds have been recorded. It is very difficult to say how increased fishing acts to diminish the size of the fish, because they are never caught until they come back into our fresh waters to

spawn; they remain at sea and get their growth there."

Mr. Goraud: "If each year a certain percentage of fish is caught of course that operates to the disadvantage of the larger fish?"

Dr. Bean: "I presume it does, but they cannot be caught at any time except in the spawning season. There is no fishery for them at sea, and the catch is limited to the time when they return to the rivers to spawn."

Mr. Huntington: "I want to refer to a stream near Smithtown, L. I. There is a stream there perhaps three miles long that comes down to the waters of the Sound. Years ago there was taken there only an occasional stray shad. About ten years ago, I do not remember the exact date of the planting, there was a plant made by the State of N. Y. in that river, and for the last two or three years there has been quite good fishing. I was over there and spent a week in the shad time about three weeks ago, and at the house where I stopped I saw them have one morning three or four shad that weighed over ten pounds apiece. I cite this to show fishermen that shad will thrive in waters that are suitable for their introduction."

Mr. Whitaker: "I think perhaps the same factors will not operate in regard to the shad and other salt water fish as would in regard to the fresh water fish of the lakes. The fish are growing smaller and there is a cause for it. As the fish increase in size the meshes of the nets have been contracted, the fish pursued at every season of the year, and the size of the captured fish annually diminishes, whereas, as Dr. Bean has said, the migratory character of the shad protects them for perhaps nine or ten months of the year. They seek the deep water regions and do not



return until they mature. They remain in the rivers only three months, and thus nature intervenes to protect them. It is gratifying to know that fish culture in the rivers has annually renewed the shad. The great obstacle to-day that is met with in almost every direction is the hand of man, there cannot be a better exemplification of the value of fish culture than the results with such fish as the shad and salmon. I think Mr. Mather's plan is an excellent one and his reference to the fact of the increase and poor maintainance of the stock in our waters, by reason of the distribution is right. In our great lake system, we have another thing to contend with, which is that a man has a right to fish throughout the year whenever he can, and this is a great obstacle to the propagation of the fish."

## DECADENCE OF OUR TROUT STREAMS.

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READ BEFORE THE AMERICAN FISHERIES SOCIETY

BY J. S. VAN CLEEF.

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Some three or four years ago an article was contributed by me to *Forest and Stream* in which the above subject was discussed, and while this is not a reproduction of that article, it must necessarily contain many of the facts and conclusions which were contained in it and which further investigation satisfies me are correct.

Every angler who has waded and fished our trout streams during the past thirty or forty years has observed the general decrease in the waterflow, especially during seasons of drought, and the decrease does not seem to be local but universal.

The Legislature of this State has endeavored to arrest this decrease, especially in the North Woods, but in spite of legislative action it still goes on steadily and uniformly, both in the "forest primeval" and out of it.

This legislative action has been based upon the theory that the causes of the gradual diminution in the waterflow are and have been wholly or very largely local, and it seems to have been assumed that if the destruction of the trees at or near the sources of our streams can be prevented this decrease will be practically arrested.

Do the results thus far obtained justify this conclusion, or in other words, are these causes local, and can the preservation of the trees at the sources of our streams do more than retard a result which is inevitable from other and more far-reaching causes?

It has not been my fortune to visit the North Woods or Adirondack region, as my fishing trips have been confined to the Catskill region and Canada. For over thirty-five years, however, I have constantly visited the Catskills, and during all that time have been thoroughly familiar with the streams of that region; and while my personal knowledge of these streams does not extend much beyond thirty-five years, yet I feel assured that the statement of facts given below will be corroborated by many persons who could be named, and who have been familiar with these streams for over fifty years.

It will be conceded that, all other things being equal, like causes will produce like results, and if the North Woods and the Catskills are alike in their characteristics, then the causes which have produced and are producing a decrease in the waterflow of one of these regions will produce a like result in the other.

The eastern part of the State of New York is divided into two immense watersheds, the northern with its streams emptying into Lake Ontario, the St. Lawrence, Lake Champlain and the Mohawk River, and the southern with its streams emptying into the Mohawk, Hudson and Delaware Rivers.

Both of these regions are mountainous, and the altitude of these mountains and the intervening valleys above tide water are substantially the same.

The highest mountain in the northern watershed is Mt. Marcy, which is 5,468 feet high, and one of the highest in the State of New York is Slide Mountain,

in the southern watershed, which is 4,205 feet high.

The lower watershed, which extends through Schoharie, Greene, Ulster, Sullivan and Delaware counties, contains fifty-nine mountains which are over 3,000 feet high. Of these, thirty-seven are of the height of 3,500 feet and upward, and of an average height of 3,728 feet.

Including this immense tract is what is generally known as the Southern Catskill range, contained within an area of perhaps thirty miles in length and twenty miles in breadth.

Fourteen mountains in this range are from 3,571 feet to 4,205 feet in height, the average height being 3,747 feet.

These mountains are covered with nothing but hard wood—beech, birch, maple and balsam. The axe has never touched these trees except to provide an occasional camp for some benighted bear hunter or lost angler, and examination shows that these trees are of immense age.

The hemlock which formerly abounded in this region and has been used so largely for tanning purposes has, with but few exceptions, been cut entirely, or almost entirely, from the valleys which are from 2,000 feet to 2,500 feet below these mountain peaks. It has not abounded nor has it been cut anywhere within many miles of the sources of the largest of the streams which rise in this mountain range.

In this range the following noted trout streams have their source, the largest ones, though running in opposite directions, having their sources very close to each other, viz.: the Beaverkill, Neversink, Rondout, Willewemoc, Esopus, Dry Brook and Millbrook.

For the purpose of calling attention to certain facts in regard to these streams I will first select the

most noted of all of them, the Beaverkill, which has its source in the very heart of the Southern Catskill range, and runs for many miles before it reaches even the smallest clearing.

There are but few of the veteran anglers in this State who did not visit the delightful fishing retreat of James Murdock, which is situated on this stream, some twenty-five or thirty miles below its source, in the fifties; and all will bear testimony not only to the abundance of the trout but also to the abundance of the waterflow.

At that time this region was always visited during the latter part of May and the fore part of June with one or more severe northeast storms, which were largely or wholly local, and so regularly did these storms occur that the lumbermen could always rely upon what was generally termed by them the "June fresh" for the purpose of rafting their lumber from a point some twelve miles below Murdock's, at the junction of the Beaverkill and Willewemoc streams, down to the Delaware River, and thence to Trenton or Philadelphia, and they could also always rely upon the high water produced by these storms for the three or four days required for that purpose.

In 1859 I encountered one of these storms just after reaching Mr. Murdock's house. He immediately started off his rafts, and my brother anglers and I waited for some five days before the waters receded to such an extent that we could wade the stream. The next day another storm of like severity occurred, and after waiting for some five or six days and finding the stream still unfit to wade I returned home, having had but one day's sport in a trip of two weeks.

About the year 1863 I had a similar experience on the Rondout stream. A severe and sudden storm had raised the stream, and it was four or five days before the stream was fit to wade.

These are isolated cases, but they are in line with my constant experience between thirty and forty years ago. It was not low water then, but high water which was most feared by anglers.

On returning home from these trips, when we had been visited by these severe storms, it was found that they had not extended to any great extent either to the east or west of this mountain region, but seemed to be almost entirely local.

These storms were almost invariably followed by strong westerly winds which usually continued for two or three days.

All this is entirely changed. The storms which prevailed so frequently thirty or forty years ago seldom occur any more, and when they do the streams run down almost as rapidly as they rise. In 1891 I was on the Rondout Stream when I found that it was nearly bank full in the morning from the effects of a storm which had prevailed during the previous night and which was followed in the morning by the usual westerly wind. The stream ran down so rapidly that in the afternoon I found it possible to wade it, and in the afternoon of the next day it was too low for good fishing.

I have had the same experience in the Beaverkill, and have found within the last few years that not later than the second day after a storm it was in good condition for fishing, and on the third day too low for any satisfactory sport.

For the purpose of ascertaining whether the rapid depletion of the water in these streams commenced at

their sources, or at the point where the land on the banks had been cleared, I made a personal examination of the Beaverkill some four or five years ago, within a day or two after a heavy storm, following the stream for several miles above the point where a tree had never been cut, and found that the water had run down almost to the drought level.

I have also found, by actual comparison, that these mountain streams have of late years run down quite as rapidly as the streams which in other places run through lands which have been cleared and drained from source to mouth, and I firmly believe that the experience of others will thoroughly coincide with my own in this respect, and if I am correct in my statement of the above facts, then I am forced to the conclusion that the cutting or destruction of the trees at the head waters of our streams is but one, and a very limited one, of the causes of their gradual drying up.

I suggest the following theory as accounting in part at least for the conditions above referred to. Years ago the lands lying west of this mountain range were very largely unbroken, the prairies were covered to a greater or less extent with natural grass, and the swamps in the low lands were undrained. Under these conditions the winds, which during that time largely prevailed from the West, were surcharged with moisture by reason of the gradual evaporation from the soil, the low lands and the swamps, and when these winds were forced up to a height of from 3,000 feet to 4,000 feet, the moisture was condensed into rain, and the mountain tops were saturated with moisture, which slowly and steadily through springs and rivulets kept up the water supply of the streams. During the last thirty years the prairies have been almost entirely reclaimed from their natural state, the low lands and swamps which furnished a large amount

of moisture to the atmosphere have been drained, the rain as it falls sinks rapidly into the cleared lands, is carried off immediately by surface drainage, and as a result the atmosphere as it blows over these lands is no longer kept in its normal condition, or supplied with moisture from the soil through gradual and natural evaporation, but rather yields moisture to the soil to produce an equilibrium, and when this atmosphere reaches the mountains of this State and is forced up to the altitude of from 3,000 feet to 4,000 feet, the moisture which it contains is not sufficient to be condensed into rain, but like a dry sponge it withdraws or soaks up moisture from the soil in order that it may be restored to its normal condition.

The same is equally true as to the forests which thirty or forty years ago abounded in the States lying west of us, and which to a greater or less extent have yielded to the lumberman's axe, or have been destroyed that the land might be opened to cultivation. The amount of moisture which scientists tell us is evaporated annually from every tree is almost beyond comprehension, and in addition the destruction of every tree submits the soil, which had been protected by its shade and had yielded moisture by gradual evaporation, to the direct rays of the sun.

Does not the clearing of every acre of the original prairie, the draining of every swamp, and the cutting of every tree in the vast region of this country lying west of the water sheds of the State of New York, through which the earth is exposed to the direct rays of the sun, constitute an unit in the process of the destruction of the water supply of our streams, and if so, would not the planting of every tree constitute an unit of force in the opposite direction?

If there is any force in the above theory, and if it is sustained by the facts, then it must necessarily



follow that our mountain streams are largely doomed, and that the preservation of the trees at or near their sources will but partially save them.

If this be true, it is to be hoped that the Board of Fisheries, Game and Forests in this State will check, so far as may lie in its power, the further cutting or destruction of the trees in the cleared lands and woods throughout the entire State, and use every effort in its power to foster a general spirit in favor of planting and preserving trees everywhere throughout the State.

## IMPOVERISHMENT OF THE FOOD-FISH INDUSTRIES.

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BY DR. BUSHROD W. JAMES, PHILADELPHIA, PA.,  
MEMBER AND VICE-PRESIDENT OF THE  
PENNSYLVANIA FISH PROTECTIVE  
ASSOCIATION.

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The time has come when the inhabitants of the United States must cease to look upon the lavishly generous gifts bestowed upon them by nature as limitless, and therefore needless of special care or protection. Wastefulness has been overlooked without fear of inevitable retribution, until the punishment is already upon us in more than one perceptible quarter. To that which relates to the impoverishment of the fish-food supply, I will devote the subject of this paper.

If we take the literal meaning of "food-fish" we must include every known animal product of ocean, river, or streamlet; for if possible, some species, which to our refined taste, are actually loathsome, are more important in their multi-usefulness than are many of those which we favor particularly with above mentioned name, and which our Fish Commissions are endeavoring to protect.

A universal impoverishment in the fisheries is making itself felt from Point Barrow all the way down the Pacific coast so that business itself in shipping is

beginning to suffer. This was once very important in whalebone, whale oil, seal skins and walrus ivory, but it has so far deteriorated as to almost ruin the coast trades in this line, while more sadly still, the natives of the northern coasts and islands have been reduced to actual want through the wholesale destruction of the once plentiful supply of animal life so peculiarly fitted to meet their various needs. Without a natural supply of wool or cotton, those which they possess being obtained by trading, the fur seal furnished to them their most comfortable garments and, next to the pelt of the sea otter, their most valuable trading staple. The seal also bestowed upon them the oil which actually was the only substitute for the milk, coffee, tea or chocolate, without which we feel it would be impossible to enjoy our meals. The flesh rated second only to fresh fish, and so precious was it that not a particle was wasted. Now with those vast herds very nearly depleted or frightened from their breeding grounds, what must become of those people who depended upon them for the necessities of existence?

So with the whale and the walrus—greed of gain has so over-grasped until hundreds of the nation's wards must go hungry, houseless and scantily clothed, simply because individuals or corporations have endeavored to sweep into their hands the whole supply in a short time while prices were good. Now whaling vessels go and return unsuccessful, seals are already alarmingly scarce and walruses are rarely seen at all; partly because they are extremely cautious and shy, but in greater part because their tusks excited the cupidity of traders to the procuring of all animals, whether mature and perfect in ivory or not. We are rather too far away to hear the cry of distress among the inhabitants of the northwestern islands, but commerce now discovers the grand mistake, perhaps too

late. A slight expression of anxiety in San Francisco gives rise to a demand for a greater protection of the finer salmon fisheries, which but a few years ago appeared to be inexhaustible.

This fish being delicate and a very desirable table food, doubtless the laws will be more effectually and carefully enforced. But the fishes, or other animal life or plants on which the salmon feed, must also be guarded from destructive depredation. Leaving the western shore of the continent, still another note of dismay is sounding from Maine to Florida! Salmon is rare in all our rivers; the great fishing banks of Maine and Massachusetts are failing; the lobsters are growing scarce and small; mackerel is almost gone from some quarters in which the "Look-out" has heretofore watched the coming schools and sent the joyous tidings to many an eagerly waiting fisherman. Herring catches in some localities are growing less and less; in some places the fishing smacks are laid high and dry because there is no longer special use for them. Some fishermen say that shad is getting scarce in some of our rivers; others assert that they, once so rarely flavored, are now at times tainted with coal oil and sewage or foul mud, and are consequently almost unsalable. And so the cry continues from shore to shore, while one of the most important industries of the country lies in jeopardy. Both the United States Fish Commission and the commissions of the several individual States have done nobly, so far as they have had prerogative, but there is still a vast amount of improvement to be made in fish protective legislation before we can feel assured of preventive measures concerning fishing in the public waterways all over the land. A very apparent defect is instituted by conflicting laws made for the control of streams which run through two or more States, whereas, if each State would consult with its neighboring ones

before maturing its laws regarding rivers and streams, and fishing therein, conjoint measures might be taken which would improve the local fisheries without injury to any one locality.

In my opinion, alert watchfulness is requisite, not only during certain seasons, but at all times, if the product is ever to be elevated to its pristine quality and abundance. Common sense teaches that fish, as well as other animals, require a certain length of time to mature and become perfect for the food of man. It affirms also that when consumers discover that they are obtaining an inferior article, particularly if at a high price, they will soon cease to purchase the commodity, giving its place to something else, thereby creating a market which by-and-by may repudiate fish as a fashionable staple for food.

One of the first and most important safeguards to the fisheries is the cleanliness of the rivers in which they are found. Chemical impurities, as well as sewage, should be kept out of fishing streams entirely, or at least as far as can be made practicable, and facilities would soon appear if so required by legislation. Some chemicals may not be poisonous, others are, and they are therefore unfit to be eaten or drunk by fishes intended for food, either for man or for other fishes. I think there might be a feasible arrangement made by which the water from dyeing establishments, mills, factories, etc., could be spread over an extent of ground through which it could percolate before reaching the stream, thus depositing the maximum of poisonous matter in the earth. Possibly the food worms of the fishes might be destroyed, but the localities devoted to these industries are sufficiently limited to allow a much greater extent of land uninjured. The dangers of eating fishes who feed in streams polluted by sewage have not as yet been considered fully, but it is ably demonstra-

ted that they are subject to very numerous parasites, some of which are not evil to mankind, while others are poisonous. More extensive and universal biological research, carried on upon strictly scientific principles, will soon make known the number and kind of dangerous parasites, and the waters which they infest, when the fish afflicted by them should be pronounced unsalable, and if no other plan can succeed in preventing their distribution, fishing in streams in which they are found should be prohibited entirely. That parasite growth is possible in fish, suggests the question whether they may not be attacked by the bacteria of diphtheria, the microbes of typhoid or malarial diseases, and even the bacilli of Asiatic cholera from drinking the river water near large cities which deposit all or a greater part of the sewage therein; if that be the case, may they not impart such diseases to unsuspecting mankind using them for food? Many people, especially the poor, eat fish and eels that are caught in lower streams whose waters are so far influenced by tides that they back up a considerable distance, yet the ebb is not strong enough to carry away the debris which they take up and deposit along the shores. This rubbish holds pools of water in check until they become stagnant, and sometimes dead fish are found imprisoned among branches, weeds, old barrels, baskets, etc. It stands to reason that any fish drinking the water or feeding in such places must become more or less subject to poisonous parasites, and thus become unwholesome for food; and if the flavor of coal oil, gas, tar and other impurities make themselves disagreeably apparent in their flesh, which is a well known fact, the probability of far more dangerous matter seems to become an incontrovertible certainty. By partaking of this infected fish, cholera and other epidemic diseases may be started in the systems of a few persons, and the contamination would

spread in every direction, afflicting even people who never touch food fishes. I think, under these conditions, each State should have laws compelling the clearing and lowering of the mouths of all rivers or creeks in which the waters lie stagnant and restricted by rubbish; that each State Commission should have a biologist, who could make known the presence of dangerous parasites, and all who are interested in fish culture and protection should join in trying to discover whether there could not be some plan adopted to destroy them without endangering the life of the fish; that the food animalculæ should be as carefully protected as the fish themselves, and that all deleterious matter should be kept from them as far as possible. I believe all States, and especially those that have coast lines and bays, should so regulate the fishing seasons that the strong, mature and fertile fish may be allowed to reach the spawning places unmolested, or else that certain streams in every State shall be closed against fishermen every second year, thus giving them a whole season in which to spawn and multiply. While some are closed, others can be opened and so alternated that there will be no danger of exterminating the fine food supply. The reward in full-grown fishes of good quality would soon compensate for the sacrifice.

If these plans are not practicable then others must be adopted. Perhaps good results would follow if fish culture were made so universal that at the time of the running of the schools to the spawning grounds men were stationed at the mouth of or along every important river to catch the fish, obtain the eggs, and hatch them artificially; then they could be deposited in fitting places, after the season was over, and thus the danger of extinction would be over.

The present style of ocean pound-nets could be improved by making the meshes large enough to allow of

many more fishes than can possibly get away now. Of course, the larger the fish the less danger there is of its being pounded to death by the others; therefore the mesh of the leader and pound-net should be so increased as to permit those of unmerchantable size to get free without injury to fins or scales. Fish weirs, or so-called eel weirs, largely used in inland streams, especially the smaller ones, should be entirely abolished by law in every State, as they are now in Pennsylvania; but if any State is unwilling or unable to procure such legislation, then all such arrangements should be legally constructed of such pliable material as to insure that the fish will not be so injured or bruised as by the present slat system. Would it not be practicable in such instances to produce screen of other material than wood, such as woven grass, canvas, or something which would not bruise the fish nor break the scales from them as they go through? If so, thousands of them would be saved from damage, which often results in deformity or deterioration, if not in death.

I am possessed of a keen interest in food fish culture and protection.

First—Because of their vast importance as the chief support of many thousands of inhabitants of this and other countries.

Second—That because through them may be promulgated disease, and the public health be jeopardized, because of the waters in which they abide becoming liable to contamination.

Third—Because of their great value as a staple commercial production of the country.

For these reasons I would earnestly urge fishermen and all those engaged in the trade to join with our American Fisheries Society in the endeavor to perpetuate the growth and quality of food fishes; and to



this end a little self-denial will be found very advantageous not only to their personal business but toward the ultimate protection and continuance of our great interests at stake in fish as a commercial element.

Therefore, let the mackerel banks alone for a year or two, and perhaps they will again be abundantly populated.

Do not try to take all the best fish from the sea and streams at one time because prices are temptingly high.

Let the lobsters have a few years in which to attain their normal growth and quality.

Do not so far overstock the market with herring and other food fish that they will become a drug to the trade.

And let us hope that there may be some way by which we may obtain the right to protect the young herring which are now caught in the waters on our northeastern boundary, and canned under the name of "sardines."

If it is possible to regulate the salable size of each variety of fish so that those below that size will not be caught, let each one conscientiously regard the law.

Undersized or imperfect commodities always tend to disqualify even the better grades of the same ; therefore, from a selfish point of view alone, every interested party should give earnest endeavor to favor any plan which points to improvement. Impoverishment has been the finale of nearly every production, and now the necessity calls upon the people and the entire government to provide ample legislation for the protection of all kinds of water animals, from the great walrus, whale, sea lion and seal of the Arctic and Pacific to the delicate

brook and mountain fishes, all of which are valuable food for either human beings, other fish, water birds or lower animals.

Perhaps it is too much to expect the States which have not been subjected to a threatened insufficiency to join with us in our protective work at present. But this State and others which have taken up the important matter, must make the propriety of their measures so prominent, and the attention to every detail in legislation so consistent, that the result will redound to their credit and provoke a spirit of emulation in those who to-day are inclined to disparage the great commercial and financial importance which, we are convinced, is attached to the numerous fishing interests of the United States,

The objects and successes of the several commissions should be understood by the general public as well as by those closely connected with the fishing business, and with their knowledge will probably be very valuable aids to the commission, aroused in districts through which excellent streams pass. When they are convinced that unclean and unhealthy matter thrown into waters will probably produce disease-breeding fish, they will not place it there, and every individual effort will have a good influence upon others. My firm conviction is that even among the most careless people, ignorance is far more to blame than intentional destructiveness.

Let the consumer, and the man who obtains and supplies, come together harmoniously on the common ground of mutual advantage to remedy the wasteful impoverishments to which I have referred, as well, as all others.

DISCUSSION ON THE PAPER OF  
DR. BUSHROD W. JAMES.

Mr. H. C. Ford started the discussion as follows :

"In regard to the pollution of the waters, so ably depicted by Dr. James, I respond that it is one of the most serious problems of the inland waters of Pennsylvania. I have endeavored to have laws passed, but through the intervention of large corporations, they have failed. Only this last year we endeavored to have a law passed, fixing a penalty upon tanneries, factories, bleacheries, etc., emptying dye stuffs into the streams, but representatives of the United States Leather Trust, assisted by ardent Tammany men, were too strong for us. In some States it is forbidden to allow refuse from saw mills to pass down the streams, but there is no legal way to prevent it in this section of the country. The fish in our Pennsylvania streams, I must say, in spite of all assertions to the contrary, are on the increase. Ten years ago they commenced to be protected and the young shad passed out of the river and went to the sea and were then safe."

"There is a regulation preventing the use of nets of a small size, and we have a law in Pennsylvania in the course of the shad season that no nets are permitted in the Delaware and Susquehanna Rivers, or in any other streams of the State. This has given the fish a chance to become mature. About five years ago, in 1890, 60,000 fry of salmon were deposited, and the fish ran up into New York State to get the benefit of the shallow and clear streams. They attained a length of nine inches up the river before coming down to sea, and remained about three years before returning. I had thought that the Delaware was too far to the

South to become a successful salmon river but this spring several hundred young salmon have been taken from the river, weighing 9 to 14 pounds, and I believe this will continue. In 1894, 500,000 young salmon were deposited in the upper river, which will return in still larger numbers. It is principally as a shad producing river that the Delaware is successful. The Susquehanna River at one time excelled the Delaware. Throughout Maryland the fish are disappearing, because fish baskets are legalized, and these have killed the young shad deposited in the upper part of the rivers, and these have decreased since a few years ago. This shows the protection afforded to the Delaware, and the value of re-stocking that river."

Mr. Henry H. Lyman, of New York, said :

"The dissemination of disease by eating fish from polluted streams impresses me that along that line great interest might be awakened among the people who take their drinking water from these same streams, and thus in remedying this, help along the matter of the preservation of the fish. As you know there are many rivers in this State that are supplying drinking water to large numbers of people, and in these same streams fish are being poisoned to death by deleterious matter thrown into the streams. I live on such a river, and many factories along the banks are daily depositing unhealthy matter in the water. My idea is to practically bring the question before the people in such a manner that they will realize that their lives are in danger, and have a law passed to put a stop to these practices, and thereby accomplish our purpose as regards the fish."

"The trouble in awakening popular interest in years past, as to the proper protection of fish has been, that fishing was considered as a sort of fad among sportsmen, rather than of vital importance to the people

themselves. I have watched the thing in the State of New York, and I believe that this sentiment is changing. It has been helped along by the action of the Fish Commissioners and Governor Flower, and with his assistance will be successful. The people are now taking hold of the idea."

"Years ago the salmon came into Salmon River in such numbers that they had to be thrown away, and white fish were caught in quantities, 10,000 to 15,000 in one net. That industry has all gone; the fish have been all cleaned out by imprudent fishermen."

"We must create a sentiment which will again see the restocking of those lakes and those waters by natural production. Put in a few thousand or a few million fry, and combine with this course a protection that means protection. We cannot get it by forming clubs along the way, but we must get legislation and foster a sentiment favorable to protection. A sentiment of protecting the food fish draws attention to this fact. Now they are taking hold of it through the influence of this sentiment I have mentioned. The people are taking hold of it; the Sheriffs are taking hold of it to enforce the law because the people see in it an element of benefit to themselves and not merely for the fly fishermen and the sportsmen."

"We have a recompense in the fact that pike, and silver pike and other fish come into the river that could not get in five years ago on account of the nets."

"It is right that we people interested in the fish business of the Great Lakes, which has been a great industry in the past, and may be in the future if not wiped out by greed, should meet together. We have much in common. We must prevail upon the legislatures of those States to do something in the same line along the lakes, or we shall accomplish nothing,

for if the State of New York passes a law that will close the season in Lake Ontario, the fishermen will go to Lake Erie, and if a law is passed affecting that, they will go to Lake Huron, and so on, so you see that we must take some course of action that will bring about unity; some movement of the legislatures of the different States that will accomplish something like unity of purpose the whole length of the States."

## THE DISTRIBUTION OF THE TROUT FAMILY.

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BY W. D. TOMLIN, DULUTH, MINN.

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It has become accepted as fact, that no member of the *Salvelinus*, *Namaycush*, or *Iridea* family, have their habitat in what is known as the Mississippi water shed.

All the cold spring streams of the St. Lawrence connections, clear up to the Canadian boundry line, are expected to contain trout, and have at some time been considered good trout streams ; while the *Namaycush* family are found in abundance in the lakes scattered along the streams connecting with the aforesaid St. Lawrence. This subject has been much debated because gentlemen have said : "such a thing could not exist !" but the proof of the fact is beyond all dispute ; the *Namaycush*, or Lake trout, are found in the feeders of the Mississippi, and are caught weighing from two to thirty pounds each.

They are a beautiful and considerable gamy fish, when caught below five pounds, and will take a spoon hook even to the highest weight known.

Up beyond Grand Rapids, Itasca County, Minnesota, and running almost close to the Rainy Lake water shed, there is a large lake named Pokegama—(pronounced Po-keg-ama, the o sounded softly)—about fifteen miles long and three to five miles wide, a deep

clear water lake fed by abundance of springs. In this lake splendid specimens of the large lake trout known as the Mackinaw trout are often caught, and give the toiling land-looker and settler a dinner of a fish not to be despised. That they are certainly trout, needs but the proof of men who have lived in Michigan where the Mackinaw trout can be had at almost any time at the hotel tables.

Mr. John C. Howard, of Saginaw, engaged in the lumber business before moving up to Grand Rapids, has caught them frequently, and often while in the woods, and his supply of meat has run short, simply took a spoon hook from his pack and getting into a canoe, has trolled but a little ways and caught a fish sufficient in size for a supper for three men.

Captain Joseph Crowther, operating a steamer on the upper Mississippi, knows the lake trout thoroughly, and catches many of these fishes every season in Pokegama lake.

A short distance east of Pokegama, is another lake, named Trout Lake, from the fact that such numbers of beautiful lake trout are caught there. In January, 1895, while visiting at the hotel, Grand Rapids, one was caught through the ice, and brought into the village, weighing about seventeen pounds, a splendid fish and having all the marks of the Superior lake trout. He was caught with a piece of bacon, cut like a strip from a fish, and sunk through the ice.

In March, two were caught weighing about three pounds each, as handsome as the proverbial beauty—the brook trout—they could not be bought, as the gentleman bringing them to the village had them carefully packed to send to a sister and brother-in-law, who scouted the idea that such trout could be found up in that country, and in streams or lakes whose natural water shed was the Mississippi river.



It is a matter of regret that these splendid fish are decreasing in numbers, but the fact has ceased to be disputed that these fish are genuine trout, the question arises, how came they in the waters, so far from streams or lakes, having any direct connection with Lake Superior waters?

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Andrew Slater, who lives on Tyndall's farm over at Pokegama lake, brought in a lake trout to-day, weighing thirty pounds, that he caught with a spoon hook, between the Tyndall place and Bender's point. It is the finest trout ever hooked in these waters.

Several fishermen tried the Trout lake fishing again last Thursday with but indifferent success. It has not proved to be a very good year for lake trout fishing.—*Grand Rapids Review.*

## EPIDEMIC AMONG TROUT IN NEBRASKA.

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In May, 1895, a serious loss of brood trout occurred in the ponds at the State hatcheries of Nebraska. This was made the subject of the following letters to the Secretary of the Nebraska Fish Commission, by Superintendent M. E. O'Brien:

BOARD OF FISH COMMISSIONERS,  
State of Nebraska,  
State Hatcheries, Omaha, May 3d, 1895.

MR. JAMES B. MEIKLE,  
Sec'y Fish Commission,  
Omaha, Neb.

Dear Sir :

I sincerely regret to have to report to your Honorable Board that an epidemic has broken out among our trout, that is causing them to die at an alarmingly rapid rate. The first time that I noticed anything wrong with the trout was about the 20th of March, when we found four dead trout in the ponds. A few days after we found ten dead trout, and two days later fifteen more. At this time the ponds were getting quite foul with the green scum or "conferva" which forms in the ponds every spring, and concluded that this was the cause of the fish dying. I immediately put the men to work cleaning out the ponds, drawing off the water from each pond separately, and raking out the leaves and scum and rotten vegetation. During the time this work was going on the fish were dying at the rate of twelve or fifteen a day. This was considerable

of a surprise to me as nothing had ever happened before in all my experience; however, I argued that as the ponds were cleaned out and the water settled that the fish would be all right again, but in this I was mistaken, for the fish continued to die as rapidly after the ponds were cleared out as before. This, to me was unexplainable, as the fish to all appearance were in a good healthy condition, showing no signs of the fungus of the cottony sort, which follows an injury to the skin, but they continued to die with alarming regularity. I then hired extra help and put them to work cleaning out the mud that had accumulated in the bottom of the ponds. We went through four ponds, shoveling out all the mud and decaying matter, leaving the ponds as clean and free of all injurious matter as on the day they were first completed; but all this work was apparently of no avail, as the fish continued to die. We then handled the fish over again giving them all a salt bath, which is a sure cure for parasites, but this did not appear to do much good. My latest experiment is to stop feeding liver and feed the fish on maggots and minnows. I do this in the hope that a change of food may do them some good. We have lost so far about eight hundred trout from one-half to two pounds in weight, and we are still losing fifteen or twenty fish a day. In all my years of work in fish culture this is the most peculiar and annoying experience that I have ever had, and I sincerely hope that I may soon discover some remedy which will prevent the further ravages of the disease that is so rapidly decimating our stock of trout. I had hoped when I made this report that I would be able to say that the danger of further loss from this unknown disease was over, but unless my latest experiment proves successful I will be at a loss what to do next, as I have almost exhausted my resources.

Yours respectfully,

M. E. O'BRIEN.

BOARD OF FISH COMMISSIONERS,  
State of Nebraska.  
So. Bend, June 1st, 1895.

MR. JAMES B. MEIKLE,  
Sec'y Neb. Fish Commission,  
Omaha, Nebraska.

Dear Sir :

On May 3rd I notified your Honorable Board of an epidemic that has broken out among our trout, that was causing the loss of a great many fish. In my report to you at that time I explained in detail the manner in which we had treated the fish, and that all our efforts to stop the ravages of the disease had proved unsuccessful.

I am pleased to say that we now have the disease under control, and the loss of fish is stopped. From a close observation of the disease and from experiments that I have made, I am convinced that the disease was caused by feeding diseased or poisoned beef livers. My reason for coming to this conclusion is, that from the time the disease first appeared among the fish up to the time we stopped feeding livers, I had tried every known remedy without avail. During this time I had watched very closely the actions of the fish and noticed that a few hours after feeding the fish would die very rapidly. When we stopped feeding beef livers, and began feeding live minnows, it was some days before the death loss among the fish was perceptibly lessened and in about twelve days it ceased altogether. Then I began to experiment by feeding the fish in a certain pond on beef livers, and the fish in the other ponds on live food. The result was that the fish fed on the livers would begin dying within twenty-four hours, while there was no loss among the fish fed on the live food.

I followed this experiment up until I had gone through each pond separately, and in every instance where the fish were fed on livers it was followed by disastrous results, and a change to the live food, minnows and maggots, always affected a cure. The peculiar part of this is that all the trout that we have in our ponds have been reared on beef livers, and up to the breaking out of this epidemic they have always been perfectly healthy. A further investigation may reveal the cause, but I must admit that it is a mystery to me at present.

On May 6th, in compliance with instructions received from the Board, I sent specimens of the diseased fish to Dr. Tarleton H. Bean, U. S. Fish Commission, Washington, D. C., to Mr. Fred. Mather, Supt. Fish Hatchery, Cold Spring Harbor, N. Y. and to Professor Bessey, of the Nebraska State University. The first sent to Dr. Bean were examined by Mr. Herbert A. Gill, Acting U. S. Fish Commissioner. Mr. Gill says that a similar disease appeared among the fish in the ponds at Northville, Mich., last year, and that the disease was cured by giving the ponds a thorough cleaning, drawing off the water, leaving the dirt exposed, covering it with lime and salting it. This treatment effected a cure and the fish have not been attacked since. Mr. Gill writes that in the way of direct treatment he knows of nothing to recommend. Mr. Mather writes that the disease is probably the same that occurred among the fish in the ponds at Cold Spring Harbor in 1890. which lasted for a period of three months, and caused the loss of a great many of their fish. Mr. Mather is of the opinion that the disease was caused by feeding tuberculous beef livers. He said: "I have changed butchers and have had no trouble since."

Prof. Bessy does not know the cause of the disease,

and cannot suggest a remedy. From the reports of Mr. Gill and Mr. Mather, and from my recent experiment, I am constrained to believe that the disease is the direct result of poison, which may be in either the food or the water, and once a fish is affected by it there is no cure, the only remedy is to remove the cause.

The first indication of the disease in a fish is a white spot, usually on the side, of about an inch in diameter; within a short time a hole would appear in this and shortly after the fish would die. Upon examination would be found that under the white spot was a patch of dead and decomposed tissue, and on the slightest pressure this would spurt out a dark fluid. This cancerous growth was more fully developed in some fish than in others. In some of the fish that died the only sign of a disease that I could discover was small red pimples on the under side of the gill cover. Fish that were attacked in this way would be suddenly seized with a spasm or giddiness, and would rush about the pond on the side for a few moments and suddenly give up the ghost. Hereafter whenever this disease appears among the fish we will be better prepared to handle it because of our experience of this season, and we need not fear any great loss from this cause in the future.

Yours respectfully,

M. E. O'BRIEN.

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#### DISCUSSION ON THE EPIDEMIC AMONG TROUT IN NEBRASKA.

Mr. Mather: "Having had experience with something of this kind in 1890 and '91, accounts of which will be found in the New York State Fish Commission Reports for 1891-'92, I will say that such things occur

somewhere almost every year. The Wisconsin Commission had a great mortality about that time, and this year the catfish in Monhagen and Highland Lakes, in Orange County, N. Y., are dying by the ton, and the shores are covered with them to such an extent that men have been employed to cart them away. I have several letters from residents of Orange County asking for the cause of this mortality, which of course I do not pretend to know."

Superintendent O'Brien, by advice of Commissioner May, of Nebraska, wrote me under date of May 6th, 1895, as follows:

MAJOR FRED. MATHER,

"My Dear Sir:—During the past month a disease, which is new to me, has broken out among the trout in our ponds, and a number of them, weighing from one-quarter to two and one-half pounds have died from it. In looking over the reports I find that you mention such a disease in the ponds under your charge, and from your description it appears like that which is killing our trout. In order to be certain of this I have shipped you by express, to-day, four of the trout taken dead from our ponds, that you may examine them. Kindly advise me if I am right in my surmise that it may be the same disease, and any information that you can give me on this subject, the cause, its final effect in your ponds or the remedy, will be fully appreciated.

Very respectfully,

M. E. O'BRIEN."

"I have no copy of my reply to Mr. O'Brien, but said, as near as memory serves: 'The trout came to hand, but the ice had left, and the fish were in the condition of "rare-ripes," very soft and bad odor. The ulcers look like those on our fish, but in each case were on the head or the opercle, while my fish were mainly

affected on the body, seldom on the head.' After my report was published, I think, I learned the cause, and believe it to have been diseased food. We were feeding beef livers and I had noticed many cases of tuberculosis in them. They came from a firm near 44th Street and 1st Avenue, New York City, and I raised a row about it, and gave orders to the man who fed the fish not to feed a diseased liver, or one that he would not eat himself, excepting only those which might be a little sour, as this condition seems harmless. When the disease broke out I watched things closely and found that instead of burying the diseased livers he had thrown them in the harbor, through laziness, and my neighbors were complaining that they drifted upon their shores. He had also cut great tubercles from some livers and fed "the good" parts. As I could not well inspect every box of liver, as business called me away often, I was surprised to find how many diseased livers had been sent, and incidentally, how much diseased beef must have been eaten in the city. On learning this, my first action was to discharge the man who had fed the diseased livers, and the next to find a reliable butcher who would not send livers affected with tuberculosis."

"Since this we have had no ulcers on the trout, and this is the first time that I have made known what I firmly believe to have caused our great loss of trout in 1890. Just how far other "epidemics" may come from similar causes it is impossible to say, but that diseased food was fed to the fish without my knowledge, I think will be accepted as sufficient cause for an epidemic."



## SOME OBSERVATIONS ON THE MORAL PHASES OF MODERN FISHCULTURE.

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BY HERSCHEL WHITAKER.

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Mr. Whitaker, before reading his paper, made the following remarks :

"Of course in a paper like this, it is impossible to give you anything like an adequate conception of the basis worked on in the Lake region. I do not know how many, but a very great many pounds of white fish measuring from eight to nine inches were salted and sold as herring, or smoked and sold. If these had not been molested, but were allowed to remain in the water three or four years, they would have been of greater value. We have had since 1891 a statistical agent every year, and his reports are very reliable, and taken by the same man every year. His report for 1892, which was the last year statistics were collected, show that fully one-half of the fish taken and marketed were number twos and under. You know what that means. Two-thirds of the catch in weight of the fish taken in the waters of Michigan were all of that size. Now it is impossible unless some general action should be taken, that the fisheries of the Lake will last long. It is within my memory quite a while ago, something like 35 years ago, I remember distinctly in Lewis County in this State (New York), where I was born, it was a common thing for the far-

mers to go to Sheboygan Bay and other points on Lake Ontario with their wares in November and bring back white fish and salmon-trout and distribute them."

"The question is what are we to do? If we can secure aid from the Legislature, we may accomplish something or this work ought to be abandoned. If the people living in the States bordering on the great Lakes have no regard as to what becomes of the fisheries, I do not know why we should lie awake nights waiting for the time to come, if it is the desire of the people that the Lakes should be fished out."

"It is not said in the spirit of pessimism, but in view of the facts in the case, and I am only too glad to know that Wisconsin has taken some action in this matter, and I believe that the new Board is going to give that Commission a new lease on life. We are too content to sit down and let matters take their course. A Commission always marks out a course of policy. It must not be content to put into the waters a lot of fish, but it must give protection. I have the pleasure to say we have recommended that resolutions be passed for the last six years that this be done. The duty of Commissioners is to hatch and plant fish; the duty of the Legislature is to protect the fisheries. I have hopes that we shall have such laws passed. He says we have it. They adjourn without giving us any encouragement whatever. As an instance of what becomes of our white fish: in 1892 our State did not obtain from Lake Michigan but 3,592 pounds of white fish; in 1895, 19,500 pounds were caught. Every man that had a pound net stored away took it out and caught these little fish and sold them. Fishermen tell us that the planting has renewed the fish. 'Why, how do you know it?' 'We take in a school of fish all of the same size.'"

"Discouragements we have to meet, and we hope

that the expression of this Society will be towards the protection of the rights of the fishermen and the interests of the people." 9

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Whoever said that "Revolutions never move backward," would never have given voice to any such sentiment had he lived in America in the year of grace, 1895, and been interested in fishculture. Charity for the utterances of another might incline us to say, that he said it with a mental reservation perhaps, or that what he meant was that while revolutions never moved backward, they seemed at times to do so, only to gain added force with which to throw down with resistless energy final and seemingly insurmountable obstacles. If this qualified interpretation were not true, the fishculturists of this country, and especially of the Great Lake region, might be well cast down in spirit and hopelessly disheartened by an important event of the past month.

On the 24th day of May, 1895, the Department of Marine and Fisheries of Canada, issued a notice that the order made in Council some years since, making the month of November (which is the spawning season of the Salmonidae) a close season for netters in Canadian waters on the great Lakes was revoked, until such time as the governments on the American side see the necessity of protecting the fish and are ready to co-operate in the work. The effect of this order meant a notice to the Canadian fishermen that until further notice they could join their American fellow-fishermen in working the final destruction of the commercial fisheries of the lakes.

The Canadian government exhibited wisdom in making the original order. The reasons for its promulgation were founded on the experience of years

of observation of the pernicious and ruinous effect of the practices of the netters on the lakes. The enforcement of the order was wholesome and resulted in better fishing in their waters than in ours. Ever since the order was given effect, the Department of Marine and Fisheries has sought by every means in its power, to urge upon those entrusted with the passage and enforcement of laws for the regulation of the fisheries upon the American side of the waters, the necessity of a co-operation with them in the passage and enforcement of a similar act. They have had occasion to feel disheartened at the result. They have had further to bear the importunities of the lake fishermen of the different provinces and the petty politicians for a revocation of the order, because the States bordering the lakes upon the other side permitted their fishermen to fish at any and all times and with all sorts of devices. And so, at last, the order has been revoked—in a spirit of weakness, perhaps—until such time as the States shall see fit to join the Dominion in an effort to protect the fisheries.

No action, either public or private, concerning the fisheries of this country, has ever been taken which may be more pregnant of evil, or perhaps of good result, if we shall profit by the lesson, than this order of revocation. The result must depend on the future action or non-action on the part of the States whose territory is co-extensive with that of Canada on the lakes, in moving for the preservation of the great lake fisheries, by the passage of just and reasonable laws controlling the fishermen. While the action of the Department of Marine and Fisheries is one to be deeply regretted it has been, perhaps, in a measure justified by the absolute lack of co-operation on the part of the bordering States in meeting the Canadians upon this question in a spirit of fairness, and with a desire to protect the public's interests.

Two principal causes have contributed to the destruction of the fisheries of the Lakes.

1. The wanton destruction of small immature fish, and
2. The netting of gravid fish upon their spawning beds.

For three-quarters of a century these waters have been fished persistently, in and out of season. The size of marketed fish has been constantly diminishing, and the meshes of the nets have as gradually been contracting in size to accommodate them to the size of the fish. They have been fished for in deep water during the spring and summer months, and with the advent of the fall the fishermen have resorted to every known spawning bed and shoal, with every engine of destruction at their command, and played havoc with the spawning fish. What may reasonably be expected when an industry is thus prosecuted? Is there cause to hope for any reasonable measure of success from plants of fish made under such conditions? Not only are the fish naturally hatched thus taken and marketed of an immature and barely marketable size, but those which have been artificially hatched and liberated are also taken before they have had a chance to aid in a natural way the restocking of the waters, thus supplementing the work of the Commissions. Add to this the indiscriminate slaughter of the spawning fish upon their beds and how long can the industry survive? The answer is before us.

Ontario, with its former wealth of fish of the finest edible character, has long since been robbed of its treasure, and the nets of the fishermen have rotted on the shore. Erie, even richer than Ontario, in fine food fish is nearing its last stage, as was demonstrated during the season of 1894, by the exodus of the commercial fishermen from that Lake to the Lake of the

Woods. The Lake Michigan fisheries have been in a large measure ruined, and fishing in many localities on that Lake has ceased to be an industry to be followed with profit. Huron and Superior have suffered seriously from the same causes, and unless prompt and efficient steps are soon taken by the Legislatures of the Lake States these lakes, with the rest, will be robbed of the white fish, salmon trout and herring. Then will gradually follow the extermination of the coarser varieties of fish, and when the last remaining school of fish shall be sighted by some greedy fisherman who is "*following his business*" every netter on the Lakes will join in the pursuit of the last schools and when they are finally captured they will be found too small even to grade as No. 3s, Chicago inspection, and they will be strewn on the shore to "lard the lean earth" as fertilizer, as many of their kinds have done heretofore. From then on the Lakes will serve only as great highways on which to float the product of the prairies of the further west; they will be barren of the wealth of food they once possessed, and the Legislator may then, unless too busily engaged in gerrymandering Legislative and Congressional "destricts," turn his attention to such passing affairs of interest as the devising of ways and means by which the fisheries of the Lakes may be restored to a productive condition.

A more selfish or senseless prosecution of an industry has never been witnessed in any age or country. With the exception of here and there an individual, the fishermen, never extended the hand of co-operation to the State in its attempts to restock the waters. We are met on every hand and at every step by their selfish greed. If we try to secure the ova of fish for artificial propagation the State must pay for handling the fish and the weight of the ova, and pay well. When the fish are to be planted they must be taken to the

localities where they are liberated on the tugs of the fishermen, who reap the first and greatest pecuniary benefit for their capture. Will he do this share of the work without compensation? No, he charges his price even for the planting; Shylock takes his pound of flesh even though it is from the heart.

When legislation is proposed for the protection of the fisheries, the fisherman is found arrayed against it, and his main argument is that it is *an interference with his business!* Is it? What is his business? To whom do the fisheries belong? Who has been striving for years to bring back the fisheries to something like their original fruitful condition by the liberal expenditure of money? It is the State in the interest of its people. The waters belong to the public, and their rights in the fisheries are paramount to that of the individual fisherman. The fisheries are theirs and whoever exercises the privilege of fishing therein does so by the sufferance of the public, and under implied understanding that he shall not prejudice the public rights therein. The fisherman in the prosecution of his business is enjoying a *privilege* and not a *right*, and he is entitled to enjoy that privilege so long as he exercises it with a due regard to the paramount right of the public to have them preserved for the future, and no longer. When he goes beyond this and threatens the very existence of the fisheries by his acts he should be called to a halt by proper laws, the same as any other transgressor against public rights.

The statistics of the commercial fisheries of Michigan reflects the condition to which the fisheries have fallen all over the great Lake system, and it may be worth while in considering this matter to briefly refer to them. The number of nets fished in 1885 was 25,893, in 1891, 36,514, in 1892, 38,283 and in 1893, 42,073.

The total pounds of white fish taken in 1885 was 8,143,626, in 1891, 8,110,387, in 1892, 6,347,535, and in 1893, 5,345,800.

There was an increase in the number of steam craft engaged in fishing in 1891 over 1885, of 20 per cent., in 1892, of 5 per cent., and in 1893 of 26 per cent.

Of boats engaged in the fisheries, other than steam, there was an increase of 94 per cent. in 1891 over 1885, of 54 per cent. in 1892 over 1885, and of 91 per cent. in 1893 over 1885.

These figures show that while there was a large increase in apparatus and boats during this period, there was an alarming decrease in the quantity of fish taken.

The causes contributing to this decay have already been alluded to, but a word further may properly be said on the subject. Since 1830 the Lake fisheries have been prosecuted with ever increasing ardor. The profits arising from the industry have been large, and the greed of the fishermen has "grown on what it feeds on." The introduction of the pound net marked the beginning of an epoch of rapid decay, and this engine of destruction, while not solely responsible, is largely so, for the rapid depletion of the waters. The erection of freezers at many of the Lake ports has also tended to the same end. They have made it possible for the fishermen to take every fish he can in the warmer season of the year, and preserve them by refrigeration until a more favorable market is presented when he can dispose of them to advantage. In fact it has made fishing profitable the year round. The result has been that the only protection afforded the fish has been the brief respite afforded by the severer winters when nature closes the lakes with a shield of ice, and when the fierce autumnal gales have swept out the nets. At all other seasons of the year the fishermen



are pursuing the fish; in summer in the deeper waters and in the fall months upon their spawning beds, where the fish, attracted by that instinct of nature, the reproduction of their kind, seek favored reefs, gravid with thousands of embryos, to spend a brief season, and are met with every engine of destruction in every locality where the fishermen can set their nets for their capture.

Twenty-five years ago the fisherman was content to capture and market white fish of a weight of from three lbs. upward, but his eager and continued pursuit of the fish soon began to tell, and fish of the larger size began to disappear. Since then the history of the fisheries has been that of a gradual decrease in size of fish and a corresponding contraction of meshes, until thousands of fish are taken too small to be of merchantable value and they have been ground into fertilizers and strewn whole on the fields to enrich the soil.

The white fish does not spawn under two lbs. weight, and bearing this in mind a perusal of the Chicago Rules of Inspection of white fish, which practically regulate the white fish trade of the lakes, may not be without interest. Under that inspection merchantable white fish are graded into three grades as follows:

Standard No. 1 Whitefish shall not be less than *one and one-quarter lbs.* dressed weight, nor less than twelve inches in length. Standard No. 2's shall not weigh less than *three quarters of a lb.*, or measure less than ten inches. Standard No. 3's shall include *all fish under ten inches in length, and weighing less than three-fourths of a lb.*

It would seem to a man of average understanding, after a glance at these rules, with a knowledge that spawning fish are killed during their entire spawning

season, that he need look no further for the causes of decay of the lake fisheries. "A candle cannot last long burning at each end." The owner of the goose that laid the golden egg, discovered too late that he had killed his goose to no avail, and so will the inhabitants of the great lake region, unless they shall insist upon prompt and reasonable legislation to protect their fisheries, will find all too late that they have calmly stood by and permitted the fisherman to gratify his greed, with a full knowledge that the result must be to rob the waters of their treasure.

The attention of the legislature of Michigan has been repeatedly called to the facts above recited, and to the necessity for legislation. They have been interviewed privately and addressed publicly on the need of legislation, which should arrest the practices now fast destroying the fisheries, and while now and then they will admit privately the force of the argument, protective legislation has so far failed. Legislators of fair intelligence admit privately that these practices are wrong and vicious, but in the same breath assure you that their constituents insist that they *must not be interfered with in their vocation*, and as the average legislator has his personal ambitions for the future, he weakly succumbs to the influence of a handful of fishermen in his district, and subordinates the public interest to his personal ambition. If the effort to protect the fisheries is to be pursued further, and we insist it should be, it must be fought out on other lines.

As honest men, charged with the responsibility of looking after the public interest in the fisheries, we must admit that it is idle to put into the waters, year after year, fish which will be captured before they are fit for market or have had a chance to spawn. Nothing can be gained by such work, not even credit for successful work, which is the only compensation most of

us receive or ask, and it is a useless expenditure of public funds. Had we not in Michigan lived in the hope that each succeeding legislature would pass the legislation pointed out as necessary, we should long ago have recommended that the hatching of commercial fish be dropped.

What then should be done? In our opinion every state and government engaged in the artificial propagation of commercial fish on the great lakes should agree to discontinue the work until the fisheries are given such protection as will insure results of benefit. Fish culture has its uses, but if the object for which commissions are created, viz.: to restore and maintain the fisheries, is to be met with methods which give it no chances of success, further planting should cease until a more enlightened public sentiment shall demand the correction of existing abuses, or until the public pulse has been sufficiently quickened to the necessities of proper regulation to demand the passage of just restrictive laws.

It seems to me it is entirely within the province and duty of this society to put itself on record upon such an important question as this, as upon all other kindred questions affecting the fisheries. I believe that the seal of condemnation of this society, which is largely composed of fish culturists and of those who sympathize with our purposes, should be placed upon everything which hinders or defeats the success of fish culture. The lake states are not alone concerned in this question. Immense quantities of white fish and salmon trout are sent from the lake ports all over the United States, they are found upon the bill of fare of every first class hotel and restaurant in the land in their season, and the destruction of these fisheries means the elimination of a wholesome food from the table of all.

But above and beyond all this there is involved a moral question in which fish culturists are concerned, and one which cannot be ignored. As commissioners we must not allow our judgment to be overcome by a desire to hatch and distribute more fish than our neighbor, simply for the credit which may be derived from a printed record, regardless of the fact whether the fish thus planted are liberated under conditions warranting any hope of success. We must remember that we are not alone fish culturists, we must further remember that we are citizens who are interested in a proper application of public funds for the benefit of the whole people, and we should see to it that public funds are not diverted into channels where, by the natural and artificial conditions surrounding them, it is clearly apparent nothing or but little can be expected in return.

There was a time in American fish culture when it was honestly believed that restocking by artificial propagation, without any other intervention, would restore depleted waters. But that time has passed, and we know after an experience of years, that common precautions are demanded of this enterprise as of all others. We, of the great lake region, have had forced upon us the fact that while to-day we are planting millions of fish in good condition in the lakes, we are hopelessly handicapped as to the results by the war of wanton destruction waged upon the fisheries by the netters, who say we will take fish in season and out of season, we will take them by any and all kind of devices, and nobody must say us nay, it is a matter of no concern to us whether there are fish for those who come after us; after us comes the judgment.

If by concert of action in the direction I have pointed out we can secure legislation which shall properly protect the work we are doing, the right of

the fisherman to prosecute his calling will be open to him for eleven months of the year under proper restrictions, his business in the end will improve, the public will be assured of a continuing supply of good and cheap food, the Canadian government, I am confident, will be willing to restore the conditions it has just withdrawn to protect the fisheries, and as honest men we may renew our efforts to restock the great lakes with a certainty of successful result.

#### DISCUSSION ON THE PAPER OF MR. HERSCHEL WHITAKER.

Mr. Peabody, of Appleton, Wisconsin, took up the discussion as follows :

"While I do not entirely agree with the pessimistic view Mr. Whitaker takes of the evils of the Great Lakes, I will say that the question is a grave one. Mr. Whitaker comes from the same part of the country that I do, and our interests are mutual."

"Last October, together with others, I made a tour of the lake region adjacent, and where there formerly were found white fish, trout and pickerel, now the fishing is almost entirely destroyed. Within the past twelve years hardly enough fish has been taken to pay for the netting. The Commissioners of the State have been planting fish in Green Bay, and on our trip up the Bay last October, we interviewed the fishermen along the line to get at their views regarding the restocking of the waters, and we found that these net fishermen, (I do not look upon fishermen with a great degree of fondness; they are a sort of pirates as a rule), but these men are all of them anxious to see that proper legislation is obtained to protect the white fish on these shores, and they said to us that on account of the planting by the Commissioners in that year, they

lost \$20,000, and one man lost \$6,000, and because of that they hope to get legislation which will protect the white fish in their own waters, and one of the points to be considered is that it is illegal to catch white fish weighing less than one pound or one pound and a quarter (I do not recall exactly which)."

"The fishermen's nets, boats and vessels are inspected, and not only that, but the men are required to give a report of the fish, as to quantity, variety and size. They have to make this report to the Commissioner. We have a very fair law; how it will work I do not know, as it goes into operation for the first time this year. Touching the fact of taking fish at the mouth of the Fox River, which has been one of the great white fish points, it is not uncommon to take pike, weighing 6 to 7 pounds and down to 3 or 4, but fishermen have caught fish weighing one pound and under. One fisherman said he had an order for one barrel, the standard weight to be half a pound, and he was unable to fill the order. We have in our new law a measure that precludes the catching of these small fish, or of taking fish within two miles of the mouth of the river, so that they will have the opportunity of propagation."

"While we were up this bay, I met a dealer in fish from Fulton Market, New York. He succeeded in buying a car load of fish and shipping it to New York. Happening to go there shortly after, I noticed on the bill of fare in a restaurant where I took lunch, "Brook Pike". I ordered some, and had one about six to eight inches long that looked very much like our Rock Pike. I asked the man where he bought his fish, and found that they came from this same dealer, and was one of the lot from Green Bay. Our present law imposes a large fine upon any transportation company taking out of the State packages of more than 20 pounds in weight, which includes pike, bass and trout, which will largely put a stop to that.

"I know we are on the high road in our State to check this wholesale draining of the public waters, and the legislature has very fairly met the demands of the Commission and their requests for this sort of legislation, and we hear reports from the public all over the State encouraging the enforcement of the laws, and while I am speaking I want to say that members of our commission are very much interested in forming fish and game protective societies throughout the State, and have succeeded in establishing six in as many different counties. We propose to have not less than one in each county, and more than one in some counties. We ought to have local organizations for the protection of the fish. I believe in a local sentiment, and the only way to have it is to crystalize it in the form of associations; and, I think, if the Fish Commissioners of the several States will work in unity, especially in the States bordering on the Great Lakes, we can adjust our legislation in such a way that it will equalize itself and be of great value."

Mr. Titcomb, of St. Johnsbury, Vt., asked if the law mentioned by Mr. Peabody restricting the weight to twenty pounds of fish shipped from the State had been passed. Mr. Peabody replied that it had not been passed, but the transportation companies had given instructions to their employees to that effect.

Dr. Bean, of New York, said ;

"Mr. Whitaker's paper set me to thinking about the relation of fisheries to fish culture. I have already mentioned the abundance of shad in California, which is a case in point. The first plant of shad was in 1872, and in 1880 the shad had become so abundant that many bushels of the young were sold for herring. People asking for herring were offered these shad. Shad are now very common in the market of that State. There being no regular fisheries for them, they are

afforded a sort of protection which has proved effective. They are caught only in salmon nets of about eight inch mesh. Only large fish are taken, so with the small demands of the fisheries and the protection of the young fish, by recent legislation, you have the result as it appears in California to-day."



## THE WORK OF THE UNITED STATES FISH COMMISSION.

BY TARLETON H. BEAN, M. D.

The work of the United States Fish Commission has been very forcibly brought to my attention by a member of this society, who is now assistant in charge of the Division of Fishculture in that organization. Having been at the head of that division for several years, and being naturally very much interested in the growth of the Commission, I was much struck by his presentation of this year's operations, now nearly finished. It is the climax of twenty-four years' continuous activity of the National Fish Commission, and represents, chiefly in the form of eggs, almost a billion in numbers. The totals of distribution of fish by the numerous stations not having been fully reported up to the present time, we will present the principal items in the form of eggs of fish and lobster.

### EGGS OBTAINED BY THE U. S. FISH COMMISSION.

Pike perch.....	450,000,000
White fish.....	150,000,000
Cod.....	120,000,000
Shad.....	115,000,000
Lobster.....	70,000,000
Lake trout.....	13,000,000

Quinnat salmon.....	4,500,000
Flat fish.....	4,000,000
Brook trout.....	1,500,000
Rainbow trout.....	1,250,000
Steelhead trout.....	1,000,000
Atlantic salmon.....	200,000
Landlocked salmon.....	180,000

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Total.....930,630,000

Besides the above output of eggs, the Commission has distributed 70,000 young rock bass and 30,000 black bass ranging from four inches in length to adult size. These eggs and fish were produced at about twenty active stations. The cost of production and distribution, including the maintenance of the stations, was about \$200,000.

I do not cite this as the greatest work done by any Fish Commission, but merely as one of the great triumphs of fishcultural operations. There are present other members of the Fisheries Society who can point with pride to their hundreds of millions of fish deposited during the past year by State Commissions:

The United States Commission was not the first in the field. The States of Massachusetts and Connecticut had commissions six or seven years before the national organization was in existence, and the American Fisheries Society, under its old name of the American Fishculturists' Association, was largely instrumental in establishing the National Commission.

The system of public fishculture, which originated in New England, has grown and increased in popularity and usefulness until there is no longer any need of supporting it except in the matter of appropriations.

The United States Fish Commission is a great fish and egg producing organization, but it can do nothing

to enforce the protection of fish. From the nature of our laws, the United States cannot protect fish except in national waters. Fishery regulations are in the hands of the States and the State Fish Commissions combine with their fishcultural operations the equally important duty of fish protection. I believe the time is coming when the States will accomplish their object and regulate their fisheries in such a manner as to give proper protection to the fish.

What do we see in many centers of active fishery? There are laws, it is true, which are sometimes properly enforced, but in other localities there is no provision for enforcing them. This is particularly true of Alaska. The only thing which saves the salmon of Alaska, the most valuable fish in the Territory, is a law of commerce—the law of supply and demand. There are fish enough to last for years to come; there are perhaps as many as there were fifteen years ago, when I first studied the fisheries. Independently of the laws regulating the capture of salmon, for the enforcement of which there is no adequate provision, the law of supply and demand offers temporary protection for the fish. The canners must sell their wares. If they could sell all they can get they would take them without hesitation. Some of them have dammed the rivers, contrary to law, so that the fish cannot get up to their spawning grounds; but inability to market an over supply is now the only efficient safeguard of the salmon.

To return to the United States Fish Commission. The annual cost of the propagation and distribution of fish and maintenance of stations is about \$200,000. The work is constantly growing; the demand for fish is increasing, but the appropriations for the past two years have been at a standstill. The Commissioners of the States, when their work is enlarged, urge their

claims for increased appropriations and do not ask in vain ; but the National Congress pays little heed to the wants of its Fish Commission. We have fallen upon a period of unwise retrenchment which has hurt the cause of public fish culture.

If the results so far obtained in the waters of the States and of the Nation are satisfactory in the light of statistics so well established, let the American Fisheries Society and the friends of fish culture in general unite in urging that the organization which has made such a splendid record be provided with the funds necessary to continue its achievements.

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#### DISCUSSION ON THE PAPER OF TARLETON H. BEAN, M. D.

Dr. James took up the discussion as follows :

"In my paper I set forth the idea of supply and demand. The fish should not be caught during the spawning season. Some movement should be started to keep them from being molested during their breeding time. If a sentiment could be created in the public mind, so that people would grasp this idea and there be no call for fish at this time, and no enquiries of the dealers for fish until after the breeding season, it would not necessitate going into other States and obtaining fish out of season. There should be a higher law inherent in the public mind to govern this question, and if this were the case, there would be no necessity for legislation on the subject, and the fish would thus be protected. There would then be no demand, and the matter would regulate itself, as well as the matter of interstate infringement upon fixed rights."

Mr. Peabody followed with the words :

"This paper of Dr. Bean's especially interests me as it refers to this matter of protection, which seems to be the paramount question, not the one of propagating fish but of protecting them after they are grown, which is the next question, and I have come 1,200 miles to get information and enlightenment on that subject, and I would like to hear the matter discussed thoroughly, and ask a few questions. What has been the experience of the gentlemen present in the different States? What methods have been the most successful in creating public sentiment for the protection of fish, and along that line, game? One gentleman made a remark that struck me forcibly about making friends of the fishermen."

"I would like to ask whether it has ever occurred to the people whether we do not make too many laws and have them too stringent, and whether we do not make laws in the interest of the sportsmen and do not look to the interests of the people who live upon the streams and lakes. We should endeavor to have legislation for the people in general. Our laws are not quite enough in the interests of the people, farmers and persons living along the streams for instance."

"Our law regarding black bass and pike makes a close season from April 1st to June 1st, preventing the catching of black bass during April and May. It is the net fisherman who is the pirate, and who breaks the law. I am beginning to think that we have too close a season. Is it not possible to allow the catching of fish with hook and line, and would it not be just as well to have an open season if caught in this way, all the year? It would be well in our State, but whether it would work well in your section, I do not know."

"I would like to ask whether there have been good results from propagating black bass, and financially has there been any success. We have not had any success in our State."

Mr. Hoxie, of Carolina, R. I., said :

"This discussion has been to the advantage of the Fish Commissioners of the different States, but I am one of the unfortunate kind who is out of the State of New York and raise fish for the market. There is one little point I wish to bring before the Society, when they make an open season in New York. They have just passed a law which cuts us off from shipping trout there up to the 16th of April. Is there not some way to fix this thing? Is there not some way in which the man who makes a business of raising trout, for what little money there is in it, can be allowed to ship them into New York to the market whenever they are fit for it? The law seems a little unjust. If I were in Rhode Island and raised chickens and turkeys, I could send them at any time, but cannot send trout to New York, it being the market for what I produce. One year New York passed a law that we should not get fish until the first day of May. I am not doing a large business, but that year we did not pay our expenses by about \$1,500. We have shipped already this season to New York over six tons of brook trout. The price has been low, but we cannot govern that if we don't get fish until the 16th day of April; but I would rather have February, March and April, I can sell then all I can raise, but later in the season people have gone out of town for the summer."

"I simply offer these suggestions to see whether something cannot be talked up, some just law made, so that we can have the privilege of selling our trout when they are fit for the market."

By the Chairman :

"One word on this matter. I take it that a close season for fish is for their protection during the season of reproduction, and that is the only interpretation to be given to it. It may work hardship for those engaged in raising and selling fish, if the law precludes them from

following their occupation. It is to the interest of the whole people that the close season should be established for the protection of fish during the season of reproduction, and the interest of the individual should be subservient to the larger interest."

"Touching the questions presented here, if you make a close season, say from the first day of September to the first day of May, for the purpose of giving the fish time to reproduce, and if you permit market men to handle during that season fish taken outside of the State of New York, the market will be open for buyers, and it would work hardship to people engaged in raising trout for market."

Mr. Dale said :

"One word in regard to Mr. Peabody's enquiry about protection of the fish. The experience in our State, referred to by Mr. Ford, is well illustrated by examples of the Delaware and Susquehanna Rivers, where in ten years the value of the shad had risen steadily in the Delaware, while in the Susquehanna they have been depreciating all the time. The Delaware river has the protection of your laws. Our salmon, and also the shad, run up into your State, and if you should make a law that would keep this fish from getting up or down it would interfere with the general interest. They must go up where they will spawn, for they will not spawn down in the wider portion of the river, and thus one State depends upon another, and the laws of the different States should harmonize. The laws have been harmonized to some extent this winter. The New Jersey Legislature passed certain laws and I am glad to say these laws have been adopted, and the Governor has to enforce them, and I hope he will not veto this, as it covers joint interests, and the different interests ought to work together, and the laws of one State ought to agree with those of the other States.

In Pennsylvania the laws cannot protect the Susquehanna River, because the laws of Maryland interfere with it. The people have the weirs set the whole season, and catch a large amount of fish. There is a dam across the Susquehanna, and the law requires that they shall make ladders for the fish to go up and spawn, and men will take a long string, and attach a shining substance to the end of it, so that it will dangle over the ladder, and the bright surface will keep the fish from going up, for they keep away from bright surfaces, and thus they prevent the object of the law. Every man wants local interests protected by laws graded so as to cover the entire State, and we have to fight off a number of laws prejudicial to other laws, and you will all find the same thing to contend against."

"In the large cities and near by you can bring the law to bear, but in the outlying districts you cannot do this, unless you can bring the people to understand that they are thereby protecting their best interests. They prefer to get people up there to board who catch the fish, and they make more money in this way. We can enforce the laws if we can convince them that by protecting the fish and allowing them to increase they can make more money thereby."



## A NEW HATCHERY.

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BY HERSCHEL WHITAKER.

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In America where the different governments, state and national, are continually branching out into new work, the mere fact of the construction and equipment of a new hatchery would scarcely create comment among fish culturists, and were it not for some reason, other than the mere statement of the fact, that Michigan is about to open a new and complete hatching station, I should not challenge your attention to the fact. There are, however, conditions in the environment of the locality of this new station, which make it somewhat unique, and I trust a brief statement of the opening of the new hatching station for the propagation of food and game fish at Sault Ste. Marie, Michigan, will be of sufficient interest to at least challenge something more than passing notice.

At what may be practically called the foot of Lake Superior, the waters of the lake plunge over a dyke of sandstone, creating a rapid of nearly a mile in length, with a fall of about 18 feet. The river at this point is nearly a mile in width, and the sandstone dyke forms the lip of an immense natural beaker of the purest water in the world, over which pours the surplus water collected in that great lake basin.

The temperature of the lake at twenty or thirty feet

beneath its surface, is about 36 degrees during the hottest months of summer, and it abounds with brook trout, which are caught off the rocks and reefs, and with white fish, salmon trout and other fine varieties of fish.

There has always been located at the Sault Rapids, since its earliest discovery, an important white fish fishery during the entire year. At the first advent of the white man there were found congregated about the rapids a tribe of Indians known as the Sauteurs, who held undisputed possession of the territory surrounding the rapids, and prosecuted fishing during the greater part of the year. At the brink of the rapids, just above where the water breaks for its fall, there are taken, in season, brook trout weighing two, three and four pounds, sturdy and vigorous fighters, beautiful in tint and form. In the lower end of the rapids the Indian style of fishing, which I do not know to be practiced anywhere else, is yet carried on by the descendants of the aboriginal inhabitants in precisely the form in which it was conducted at the time of the discovery of the country, and it may be observed on any day during the spring, fall and summer months.

This method of fishing may not be without interest to those who have never seen it and I will describe it briefly for your information. The outfit consists of two Indians with a canoe (formerly of birch bark, now of wood) two setting poles, and a net strung on a hoop perhaps thirty inches to three feet in diameter, with a handle about ten to twelve feet in length. This is all the equipment they require for the sport or work, to be characterized according to the point of view from which the operation is observed. The canoe is propelled into the river near the foot of the rapids by an Indian in each end of the canoe, and it is swiftly and strongly driven into the rapids. The net lies across the thwarts

within convenient reach of the Indian in the bow, ready for instant use. He watches intently for his quarry while the canoe is being pushed steadily forward through the boiling rapids, in which the uneducated eye of the white man would never detect a fish; of a sudden there is a shrill cry from the bow Indian, he throws his pole into the bottom of the canoe, grasp his net, plunges it into the current and with a rapid movement it is driven to the bottom, is moved downward with the current, and is as quickly lifted out with one or more struggling and delicious white fish. This operation is repeated time after time until the fishermen have what they desire. As has before been stated, this method of fishing is now prosecuted in the same manner as when first seen by the early explorers, without change or variation.

The remnant of the tribe now living at the Rapids still follow this mode of fishing, and their livelihood is chiefly gained from this source, supplemented with the money derived from tourists who "shoot the Rapids" under Indian guidance. Many of the vessels navigating Lake Superior are furnished with fresh white fish taken in this manner by the Indians. While the fishery is confined to this method of fishing alone, it still remains fairly good, although the fish are of course less abundant than in former years. Fine brook trout can be taken at all points in Lake Superior with which I am familiar, and many of the rocky reefs in the Sault river afford most excellent fishing for brook trout of good size.

The Sault river forms the boundary between the United States and Canada, and was formerly one of the most picturesque localities in the country. Both shores of the river, and especially the Canadian side, were dotted with beautiful wooded islands, and between them ran swift and sparkling channels, in which the finest of brook trout fishing was to be found. But the march

of so-called civilization has within five years worked a great change. Two magnificent ship canals have been constructed on either side of the rapids by the different governments, and the islands have been largely obliterated in the construction of these "improvements." There are yet five islands lying in the rapids on the American shore at varying distances, approximately, from the mainland of from twenty to one hundred yards.

The superior natural advantages here afforded for the establishment of a combined white fish, brook trout and salmon trout hatchery, supplied with water which is the natural habitat of the brook trout, white fish and salmon trout, challenged the attention of the Board a number of years ago, but other necessary work demanded our attention, and no steps were taken to begin operations there until four years ago. At that time we established an experimental station in a rented building at the Sault, to settle, as far as possible, certain conditions about which there was an uncertainty. The experience of three years operations has fully demonstrated that the situation is desirable in every point of view, and during the last autumn a new hatchery was constructed, which at the beginning of the next hatching season will be in full operation.

The hatchery is located on one of the islands above referred to, near to the mainland on the American side, being separated from it by a narrow channel, and consists of a building 40x82 feet in size. One-half of the ground floor of the building will be fitted up for the hatching of white fish; the other half will be used for the hatching of brook and salmon trout. The trout portion of the work will be operated with a gravity supply of water, having a head of about seven feet. The white fish part of the house will be furnished with water by a pump run by electric current. The house will have a capacity of an annual output of approxi-

mately forty millions of white fish, three million brook trout, and five million salmon trout. The building is two stories in height, and the upper floor has been finished off with living rooms for employees, a shop, and a large room for storage purposes, etc. The interior of the house will be equipped with fire pipes, hose, etc., and the Electric Light & Power Company, located in the immediate neighborhood, will be connected with the hatchery by an electric alarm, and in case of fire the whole hatchery can be flooded almost instantly, thus affording ample fire protection.

A railroad spur is now being constructed to a point abreast of the hatchery on the mainland, and will be separated from the hatchery by the narrow channel above referred to. The cans of fry will be carried from the hatchery to the car by a carrier running upon a trolley wire, having a capacity of about a dozen cans.

When completed there will be thirty ponds constructed immediately below the islands on which the house stands, in which will be carried the stock fish of brook trout needed in connection with the work of the station. The main current of the rapids now flowing over the place upon which the ponds are to be constructed, with a depth of from two to four feet, will be diverted and controlled by a dyke or embankment, and inside of this dyke will be constructed the ponds for holding the parent fish. A canal inside this dyke will be made, from which will be taken the supply necessary for the ponds. The water of the rapids is unequalled for the purpose required, being thoroughly aerated in the boiling and seething rapids will be ideal in its character for carrying fish in ponds, and the supply is limitless.

The island itself and grounds connected with it, together with the ponds, will be embraced in and become a part of the United States Canal Reserve on which

are the locks around the rapids. During the coming summer and succeeding one, the hatchery grounds will be fashioned into a beautiful park in conformity with the general parking scheme of the United States Engineer's Department, and when all is completed the hatchery and ponds will not be the least attractive feature of the park.

## THE ARTIFICIAL HATCHING OF WHITE- FISH AND BROOK TROUT, AND THE RELATIONS OF PLANTING TO RESULTS.

BY SEYMOUR BOWER, SUPT. MICHIGAN FISH COMMISSION.

Perhaps the history of fish cultural operations on a scale of any magnitude affords no sharper contrast in appreciable results than is shown in the planting of brook trout in the streams of Michigan, and the planting of white fish in the Great Lakes. We cannot of course trace results as closely in one case as the other, because it is impossible to determine what proportion of the yield of white fish is due to artificial propagation, and what proportion originates from the native stock, while it *is* positively known that practically all of the brook trout in lower peninsula streams are primarily the result of planting,

But we are confronted with the fact, that from comparatively small annual plantings, over a thousand non-indigenous streams are to-day so well populated with brook trout that the State of Michigan ranks second to none in the value of her trout streams, while in the face of annual plantings that run into the hundreds of millions, the yield of white fish has steadily declined. In one case, a supply that is constantly increasing has

been introduced and built up from zero ; in the other, a large native stock has been greatly reduced. It is true that the returns show that at a few points the shrinkage in the catch of whitefish has been checked, but the aggregate for the entire lakes has fallen far below that of ten or fifteen years ago.

On the other hand, we find that catches of one hundred brook trout per day, per man, are now too common in scores of our streams to attract attention. On the first day of May, 1894, over 5,000 trout of legal size were taken from a single ten mile stream in the southern part of the State, a stream that a few years ago was hardly considered capable of supporting brook trout at all. Abundant results are also reported from all quarters of the State, and the returns already realized compensate the cost of production and distribution many fold, amply justifying the work on grounds of public policy. These results are quite the reverse of what was at first anticipated, as the white fish are returned to indigenous waters, while the trout have been placed in waters in which the species had never existed.

The fact that the planting of white fish has failed to prevent a growing scarcity of mature fish, and a decay in the fishing, is necessarily involved and interwoven with economic abuses incident to the extent and methods of fishing ; and while it is not my purpose to discuss the needs of restrictive measures, some reference to this phase of the subject is necessarily in order, otherwise those unacquainted with the facts might in all fairness conclude that the planting of white fish has been wholly barren of results.

Reliable statistics show that over 70 per cent. by weight of the white fish marketed from Michigan waters of the great Lakes are not sexually mature. The percentage by count is of course much greater ; so that for years, independent of the enormous loss in their



ultimate commercial value, a large proportion of the current stock has contributed absolutely nothing towards keeping up the supply. Reproduction is still further minimized through the removal of large numbers of adults on their way to the spawning grounds. The location of every white fish spawning shoal of any consequence throughout the lakes is well understood, and the migration of schools of parent fish towards these well known focal points, and their concentration thereon, affords a favorable opportunity for capture by the wholesale, and the interception of this annual pilgrimage towards a common Mecca for a common purpose constitutes by far the most profitable season of plunder for the Bedouins of economic warfare. Substantially the same condition of affairs exists throughout the American waters of the lakes. There are other abuses that tend towards a speedy extermination, but sufficient is shown to develop the important fact that for years natural reproduction has been restricted to the narrowest limits and is gradually approaching the vanishing point. We are therefore forced to the conclusion that much of the yield of white fish for the past few years and much of what remains is due to artificial propagation.

But notwithstanding all this, notwithstanding that the evidences of substantial and profitable returns clearly warrant a continuance of the work, we must acknowledge that vast numbers of the planted fish are still unaccounted for. The discrepancy between the number of fish planted and the number caught is too great for belief that the possibilities have been realized or even approached. We find that during the past 10 or 12 years, upwards of twenty-five white fish have been deposited for every one caught; that less than five per cent. of the fish turned out equals the whole number taken; so that if ten per cent. of the planted fish had

survived to the average size taken, either the catch might have been doubled or the supply would have held its own through the agency of artificial propagation alone, without any assistance whatever from the natural hatch. In view of the relative numbers of young brook trout and white fish turned out and the striking contrast in visible results, we may fairly conclude that a large percentage of the trout have survived, while there is little room for doubt that 95 per cent. of the white fish have perished.

Up to the hatching point, so-called, artificial propagation saves the enormous waste that occurs in a state of nature and thereby multiplies results a hundred or a thousand fold; this is possible only because the conditions that are taken advantage of, and all the essential features that contribute to this result, are under our immediate observation and control. When ninety healthy fish are produced from every hundred eggs taken, as is now the case with white fish, there is little leeway for improvement in this direction. But progressive fish culture demands something more, and progressive fish culturists should not rest on their laurels, nor relax their efforts, simply because a supply of germs in prodigal numbers, and a knowledge of how to fertilize and bring them forward to the hatching point, has so cheapened the cost of producing fry by the millions that the narrow margin of survivors to the age of commercial value, more than compensates the outlay. The important question for progressive fish culture to answer is, how shall the percentage of survivors be increased? May not these millions of fry be so placed or disposed, that the loss by starvation and predatory fishers will be greatly diminished? Who can compute the enormous material wealth that would be created if the ratio of survivors might be increased from five to fifty, or to twenty-five, or even ten?

The solution of this problem of how to increase results, would also simplify some other complications, for with a fair ratio of increase in the number of survivors, their capture as fast as they matured, whether on spawning grounds or off, could not be regarded as economic abuse, *so long as artificial production was continued*. It would be no violation of economic law to annually harvest the matured crop in its entirety, and wholly without regard to natural reproduction, like any other cultivated crop, provided there might be a fair return from the abundant sowing made possible through the saving economy of artificial treatment of the seed. When these returns shall be able to force the production of mature white fish to its maximum without aid from the natural hatch, the only closed season indicated would be that during which the adults are associated with the young and immature fish, or in other words, before, not after, the natural sorting and grouping and massing of the parent fish had begun for the purpose of reproduction; for, unlike the pike perch and many other spring spawners, white fish separate entirely from their own young during the spawning season. This conclusion must not be considered as applying to such kinds of fish as may not be propagated artificially and which guard their spawning beds, an important function, during the continuance of which they should not be molested.

The presumption is strong that a better knowledge of the "subsequent proceedings," a more thorough understanding of what constitutes appropriate environment, would enable us to plant more intelligently and thereby greatly increase the abundance of the harvest. A knowledge of early food conditions, its presence and abundance, as determined by previous examinations, would indicate where to plant and in what numbers the young fish should be set free in any given lo-

cality, and thus enable us to avoid planting in the wrong place, and over-planting in the right place.

If a definite number of artificially hatched fry might be transferred to strictly natural environment at the moment of hatching, no doubt the results would equal the results from a like number of fry hatched in nature. It therefore follows that if the ratio of fish matured from the former is less than from the latter, it is because we have failed to equalize conditions at the start. There are strong grounds for belief that this ratio is less, and that the unequal start in the race for life is responsible for the difference.

The white fish, unlike the small mouth black bass, which protects its bed from the depredations of spawn eating fish, fans away the sediment that might smother the embryos, separates the fungussed lumps by an occasional quick "flirt" of the tail, and thus produces a group of 2,000 to 6,000 young fish from a deposit of 10,000 to 15,000 eggs, casts its spawn and immediately departs, leaving such of the germs as may have been fertilized exposed for a period of five or six months to manifold agencies of destruction; to the mud puppies and spawn eating fishes that assemble and lurk for the rich feast that awaits them; to the deadly blight of fungus, and to be washed away from the reefs to settle and smother in mud and sediment. The percentage of fry produced under such circumstances must be very small; in fact, one of those poor germs must feel something like the man who, after listening to an exhortation wherein it was shown that over 400,000 persons go to the bad place for everyone that succeeds in getting to Heaven, retired with the remark: Brothers and Sisters, you are all welcome to *my* chance." And yet, from this source alone, the lakes were once teeming with white fish, at a time, too, when predatory fishes, to prey on the young, were present in much greater abundance

than in recent years, If started on terms of equality the planted fry of to-day are less handicapped than the natural hatch of their ancestors, and should produce a greater instead of a less percentage of results.

The tremendous advantage of art over nature in the propagation of white fish is unquestioned up to a certain point; but there is a point where this superiority suddenly ceases. Where is this point? When has this dividing line been reached? At what stage do the resources of art suddenly lose their cunning? Is it well along towards the time of hatching, when the embryos require no further manipulation or treatment? Or is it at the moment of hatching, or five, ten, twenty or thirty days after hatching? Little heed seems to have been paid to this important point, replete with significance though it may be, for until the past two seasons, the disposition of the fry has almost universally been governed by tank capacities and transportation facilities and a desire to make the widest possible distribution. As a result, considerable proportions of the hatch have been massed by the millions in the narrow and inadequate quarters of hatchery tanks, held back as long as a feeble spark of life remained, unmindful of the fact that to be on an equal footing with nature's fry, they should be liberated almost at the moment of hatching.

White fish fry, as such, are never stronger and more vigorous than at the moment of hatching. We find it imperative in practice that they must be moved at once if we would avoid losses in the house and on the road. When denied access to natural food conditions, as perforce they must be in hatcheries, and massed in large numbers, they grow visibly weaker within five days, and in ten to fifteen days many die, while the survivors are so weak and attenuated that

there is little hope for their recovery under any conditions; the vital spark is too nearly extinguished to be relighted. It is therefore reasonable to suppose that millions on millions of fry have been turned out only to perish, as a result of being held too long, thus denying access to appropriate food at the most tender and critical period of their existence. I wish to say most emphatically that these statements are not made in a spirit of criticism nor with an assumption of superior knowledge; they are made solely with a view to pointing out and profiting by what seems to be one of the reasons for the disappointing results that have attended the white fish work.

There is much in support of the general proposition that *all* fish require food almost as soon as they are able to swim freely. The white fish, unlike the brook trout, is a free swimmer the instant it succeeds in breaking the walls and escaping from its embryonic prison. Its so-called food sac is small and nearly absorbed, and though the further absorption of the yolk-sac is undoubtedly capable of keeping the fish alive for a time, the elements thus supplied cannot properly be regarded as food, while there is much to indicate that it fails to contribute *all* of the elements that are essential to a *normal* development. We know by actual observation that when confined in aquaria and freely supplied with plankton, they at least attempt the capture of minute animal forms, within one to three days after hatching, and sometimes with success. May not these real or apparent efforts to take food be regarded as springing from a sensation of hunger?

We find that the young of black bass begin to take food within forty hours after they rise from the spawning bed. We also find that within a few days after hatching, pikeperch fry become so hungry for something not supplied by the sac that they seize upon one

another before the sac has wholly disappeared, and in a short time thereafter all the fish in a tank are destroyed in this way. We find, furthermore, that brook trout and all other large sac salmonids demand food as soon as they swim up, and that a lavish display of food at this particular time, dispensed at frequent intervals and in unstinted measure, is an important factor in the rearing percentage. We may substitute the natural food, but cannot successfully deny some form of sustenance other than that supplied by the sac. Most of the trout distributed by the Michigan Fish Commission have been put out before they could swim freely, and the others have been fed; but in either case, natural food or a substitute was available when demanded. May not this pregnant fact have had an important bearing on the generous results that have followed? The conclusion therefore seems a sound one that the time when the young of all kinds of fish require external contributions towards a normal development, dates from near the swimming point. If not, then there is little value in analogy and inductive reasoning as applied to known facts.

In this connection, brief mention may be made of recent experiments, on an unpretentious scale, at the Detroit station of the Michigan Fish Commission. During the recent hatching season, successive hatchings of white fish fry, in small numbers, were placed in the Detroit river, confined in small enclosures of wire cloth. The contents of some of these boxes have been lost through being pulled up and overturned or emptied by passing boats or boatmen, and others have been used up by preservation at stated intervals of a definite number for examination and identification of the stomach contents, which is in the hands of a competent scientist. So that at the present time, June 8th, only three boxes remain that have not been disturbed, ex-

cept for the purpose of inspection. The fish in these three boxes have suffered but little natural loss, have grown quite rapidly and are now from one to one and a half inches in length. They were hatched April 20th and placed in the boxes the same day.

Three lots of fry of different hatchings were placed in small aquaria at the hatching station and have been fed exclusively on plankton from the river, daily towings being made for the purpose. These have grown faster than those in the river. Five or six specimens are fully two inches in length, and twenty or more have already developed the adipose dorsal.

Under a microscope the stomach contents of the aquarium fry show some microscopic forms, but for the most part comprise only such forms as are clearly visible to the unaided eye. In the aquaria, these forms dart about with great activity, a flea-like movement that often enables them to elude their pursuers, though singled out and followed and struck at repeatedly by the same fish. Their vigilance and ability to suddenly vamose, and the difficulty with which their capture is effected by strong and vigorous fry, suggests the thought that if the regimen of the millions of half-starved and emaciated fry that have been turned out, was restricted to *this* particular class of forms, their failure to report later on is readily accounted for.

The results of these experiments, meagre though they may be, have a special value in that they strongly indicate that a reasonably exact knowledge of all the essential conditions to be considered in planting, are within our reach. We are enabled to catch a glimpse of what it seems possible to accomplish through a systematic and scientific investigation of the waters, with special reference to the white fish problem, and along the line of inquiry suggested by these experiments. Several years ago an investigation of this nature was



begun and ably conductud by Prof. Forbes, for the U. S. Fish Commission; but for some inscrutable reason it was dropped. There is urgent demand for its resumption all along the line, by every Commission engaged in the propagation of white fish. A source of great material wealth is on the toboggan; and if we fail to employ every available means of checking its rapid descent, we fail in our duty as agents and trustees of a vast public estate, with its still vaster possibilities. We should be keenly alive to the fact that the mere production of fry, though in vast numbers represented by 8 and 9 figures, or even 8 *times* 9 figures, in and of itself has no concrete value. We should arouse to the fact that the value of fish culture as a public enterprise, or considered from an economic standpoint, is not measured by the number of fish hatched, but by the number matured; and this paper will have accomplished all that was intended if it emphasizes the fact that hatching without intelligent discrimination in planting, is a ship at sea without a rudder, an arch without a key-stone.

## GAME AND FISH PROTECTION.

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BY FRANK J. AMSDEN, PRESIDENT OF THE NEW YORK  
STATE ASSOCIATION FOR THE PROTECTION  
OF FISH AND GAME.

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At this moment the game laws and their enforcement are better than ever before. This is due to a very large extent to the activity of the friends of the law and through their organization.

We ask, and we think that we are not unreasonable, that all animals, birds and fish, should be undisturbed in their breeding season, and that they should be allowed to mature; and that nets and unlawful devices should be prohibited, except that nets may be used for food fish, under license and regulations by the State Fish Commission.

Prior to 1890 the game laws of this State were a mass of patchwork, confusion beyond measure, susceptible of almost any construction, and feebly enforced. About this time Gen. R. U. Sherman, Robert Roosevelt and Edward J. Whittaker, a committee appointed by the Legislature, after a very thorough investigation, submitted a bill of codified laws. It was passed, but not until it was sadly mutilated for selfish ends, or in the interests of the murderous element; but notwithstanding all this, so superior was its superstructure that

it is to-day and will remain a standard not only for this State, but for all other States, and a monument to its builders. It repealed all the old and antiquated laws and made a basis upon which much good has since been built up.

But, gentlemen, no matter how good your laws may be, if not respected and enforced they are useless. A public sentiment in their favor is absolutely necessary. How to secure this is the problem. In this State we have, we think, found a solution in organization. In 1890, after the work of the Commission just mentioned had been accomplished, and encouraged by a set of laws that were clear and comprehensible, and by articles that appeared in the *Forest and Stream* signed "D. H. B." (Gen. Dwight H. Bruce, of Syracuse), several hundred enthusiastic lovers of the rod and gun assembled in Syracuse and proceeded to reorganize on a protective basis the old State sportsmen's association, which had declined into an annual trap-shooting tournament, changing the name to New York State Association for the Protection of Forests, Fish and Game. Its subsequent meetings have been largely attended and deep interest has been shown for better protective laws and their enforcement. Local clubs or branches have been encouraged and formed throughout the State. We feel our increased strength and realize a rapid changing of public sentiment—particularly so whenever a local club is formed. Our influence is now felt at Albany as it was never felt before. We find that the Fish Commissioners appreciate us and look to us and our work as a great auxiliary to theirs. The protectors also regard us as their friends and supporters. It encourages them to be more active and enables them to secure more convictions than formerly. I firmly believe that this is the true and best method to pursue. The friends of fish and game must organize and combine, if we would save

the birds and fish. It should be done all over the Union. It should be done locally and then in combination for strength. The local club can change public sentiment and control their representative, and the general organization can then frame the laws as desired and carry them through the Legislature. "In union there is strength." This has been our experience. Results have exceeded our expectations. We are very greatly encouraged.

The past winter at Albany has been an active one. The Senate Committee, who were instructed by the previous Legislature to prepare a new game bill, have shown a very deep interest in the subject, far more than any previous committee. They held a number of hearings in different parts of the State during the summer of 1894, at which representatives of this Association appeared and were received in a very courteous manner. The bill which they presented was in many ways a decided improvement on the existing law. Many ambiguities and contradictions were removed. The law was simplified and made clear. Seasons were not materially altered, except to make them uniform, which was one of the main principles adopted at the beginning. In carrying this out it was necessary to change the open season on wild fowl, ducks, etc., so as to conform to the season on Long Island. This is unfortunate, for our Association as a whole desires to see spring shooting abolished everywhere, believing it all wrong; and that, if persisted in, it means the total extinction of the species. But Long Island interests will not yield, therefore shooters throughout the State became restive and demanded the same privilege; and they are right. It was justice; and so the law was made uniform throughout the State, making the open season to May 1st. Our Canadian friends complain bitterly, and well they may, for their close season on

ducks begins January 1st. Much criticism is made on the strictness of Canadian laws for both birds and fish. But I believe that unless the people on this side of the border do follow their example, the wisdom of the Canadians will be very apparent, for they will have all the game, and if we want any shooting and fishing we Americans will have to pay them for it.

I must not forget to mention the fact, and it certainly is very gratifying, that our State Association law committee was shown such confidence by the Senate Committee that they were asked to assist in drawing up the bill that finally passed the Senate in most complete and satisfactory form, more nearly perfect than they expected to get it in a long time. This was a great compliment, and our Association appreciates it, for it shows conclusively what we have gained by organization.

I almost forgot to mention a new feature of the game law, which is a provision to license, under proper regulations prescribed by the Commissioners, the use of nets in some of our inland waters. After our experience with Lake Ontario, a body of water which has been exhausted by unrestricted netting, many of our associates looked with disfavor on this innovation, fearing that the privileges granted would be abused. As the provision was adopted on my suggestion, I sincerely hope that the plan will not prove unwise. Very much will depend on the care taken in preparing and enforcing the regulations.

In many of our inland waters there are vast quantities of desirable food fish, white fish, frost fish, bullheads, etc. These are not game fish and some of them cannot be taken by hook and line. If netted they will afford an excellent food fish for the people of the localities where found, and I believe that this concession will remove much of the friction now existing between

these people and the friends of game and fish protection. Possibly, too, the netting will prove of advantage to the game fish by removing to some extent the competition for food and the destruction of their spawn.

As I have said, the bill left the Senate and went to the Assembly in a form which we thought was about perfect. I wish that I might stop here and say no more. But as a citizen of New York, the pioneer State of fish culture and game protection, I must confess my shame at the amendments incorporated into the measure in the Assembly. Slight changes were made in the general features of the bill, and this we consider fortunate, for we had grave apprehensions. But in some very surreptitious manner and at an hour when it was impossible to correct it without endangering the entire bill, a section was incorporated, No. 249, the effect of which is to foster and encourage crime, to put New York in the position of a fence, a receiver of stolen goods. This section will be a disgrace to our State as long as it shall be tolerated on the statute books. It permits the sale of game the entire year around. It says to the marketshooter, "Go to our sister States, shoot their game in season and out of season, invoice it and ship it to the old Empire State and we will help you to dispose of your unlawfully gotten plunder." And further, it says to those of the same disposition as to our own State, and there are many of them, "if you can get game out of season without being caught by the protectors, box it up tight and mark it eggs or dried apples, or by some other deceptive name; we will take care of it, and when it has been mixed up with Pennsylvania or Michigan game the difference cannot be told, for the invoice of your fellow market-hunter of Pennsylvania or Michigan will cover it all."

Such a blot on our statue books must be wiped out at the earliest moment. I shall not be content until it has been.

The thought occurs to me that our sister States must regard us with fine scorn and indignation for thus offering a premium to their own law-breakers for the paltry gain to be won. It would be only reciprocity for these States to offer the same premium to our own pot-hunters.

But such backward steps must not discourage us. Keep up the ranks and march in line. The victory is surely with us. The fish, the birds and the game animals in their wild condition belong to the people, and the public is now beginning to recognize this fact and to demand the preservation of its interests; and our law-makers are beginning to hear the demand, and they must give heed to it.

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## DISCUSSION ON THE PAPER OF MR. FRANK J. AMSDEN,

Mr. Edward P. Doyle, of Staten Island, in defense of the recent game laws, spoke as follows:

"Mr. President and Gentlemen of the American Fisheries Society:—The gentleman who has just read a paper has spoken of the crowning iniquity of the game laws, and inasmuch as he has spoken so very strong and has been so severe in speaking of it as a blot upon the statutes of the State, I think it well that I should tell what this law is that he construes as so deadly and dangerous."

"The Game, Fish and Poultry Dealers' Association of this city, whose members Mr. Amsden characterizes

as "pirates" and men in a disreputable business, so to speak, is an Association composed of prominent men of this city, men like Offman and Robbins, of Fulton Market, and who have formed an Association to get what were their rights and what they were entitled to. They claim that large quantities of game was killed west of Chicago and shipped to every city of the U. S. except the city of New York, but that this great city of over 1,500,000 people was the only city, except in N. Y. State, where game could not be sold that was legally killed in other states. They sent a Delegation to Albany, or rather they first went to their Attorney and he drew a bill, which was introduced by an Assemblyman named Wilkes, and it was reported unanimously by the Committee, and finally ordered to a third reading, and would have been passed by the representatives of the people of the State of New York, and that bill was called to the attention of our people. Its adoption would have given too much latitude to the introduction of foreign game. The Chairman of the Game Laws Committee who is just as much a protectionist as any member here, called in Senator Guy, one of the active members of the Senate, who is familiar with game laws, to modify the Wilkes bill so that ample protection would be afforded to game in the State of New York. Senator Guy modified the bill, so that game coming in must be killed 300 miles from the State of New York. This would take in Chicago, and providing that the burden of proof was on the dealer that the game in his possession had been legally killed, and killed 300 miles from the State of New York, whether North, West or South, the transportation companies must mark such game, giving the place it came from, and mark invoices and way bills, and enter same in books at office. This information should also be entered in the books of dealers, and they shall permit the fish commissioners to examine



their books at all times for the purpose of tracing game. The game to be brought in is killed, the larger part of it, west of Chicago. We have no right to presume that laws are openly violated in the Western States nor to say the people out there are poachers. We should presume that the laws are enforced and believe that this game was legally killed, and the good sober sense of the members of this society will accept this view. This society ought not to go on record as having said that reputable dealers and reputable transportation companies are openly violating the laws and swearing to false statements. Of course, as far as I am concerned, I belong to that unfortunate class who are not able to have game on the table and have no personal interest in the matter.

"I do not wish the statement to go on record that this is a blot upon the records of this State, and it ought to be wiped out. If it was proposed to send me to the Senate I would fight very hard to prevent this 'blot' being wiped out."

Question by Mr. Amsden :

"Do I understand you to say that the Legislature passed an act requiring that packages be properly marked game, the place they came from, and their destination?"

Answer: "The provision was made by Senator Guy that game should be marked game when brought in."

By Mr. Amsden :

"Mr. President, I do not want to get this meeting into a discussion on this matter. I think it will be well to let it rest. Before next winter I am perfectly satisfied in my mind that this bill will be repealed.

"Mr. President, you know what cold storage houses mean. You have seen the result in the Great Lakes,

and this is one of the causes of the depletion of the lakes. How it will affect the game in New York State is uncertain. I actually know of one hunter living just west of Monroe County who last year acknowledged having shot 400 head of game birds and shipped them to New York. Our inspector was on the watch all the season and knew it, but we never got track of it. The law prohibits the shipment of game from one county to another. People can live without game, but I have boys, and want to see the coming generation have a little sport."

By Mr. May :

"This being an American Fisheries Society, it has little to do with game, and I believe that the sentiments expressed represent the two different sides of the question, and with your consent we will allow this matter to be passed over, and we will proceed with the further reading of papers, and as it is not within the provisions of this Society to consider the question of game, we will let it drop."

## FISH FUNGUS AT CALEDONIA.

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BY PROF. CHARLES WRIGHT DODGE.

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DEPARTMENT OF BIOLOGY,  
UNIVERSITY OF ROCHESTER,  
ROCHESTER, N. Y., *June 11th, 1895.*

FRANK J. AMSDEN, Esq.,  
Rochester.

MY DEAR SIR:—

The object of the experiments on the growth of the fungus (*Saprolegnia*) infesting the trout at Caledonia is to find a means of preventing, or at least retarding, the development of the fungus without at the same time killing the fish. It seems very evident that the whole body of water in Spring Creek contains the spores, as well as the growing plants, of the fungus. A single mature plant will produce many thousand spores under suitable conditions. Each spore is capable of producing another plant which in two days or less reaches maturity and, consequently, produces its quota of spores. Each spore is provided with a pair of delicate thread-shaped motile organs, by means of which it swims about in the water, like an "animalcule," until it finds a favorable place to grow. It then attaches itself to the substratum, which may be the dead and decaying, or frequently the living, body of a fish, snail, frog, insect, or some plant in the water. The

motile organs are withdrawn into the substance of the spore, and small root-like outgrowths appear at the attached end of the spore and hold the latter in place as well as absorb the nourishment from the substratum. These spores, then, are not only able to swim about in stagnant water (to say nothing of being disseminated by flowing water) and to select a suitable place for development, but having found such a place, they are maintained in position by the firm attachment of their roots which are capable of penetrating not only the slimy skin of a fish, but even the hard shell-like coating of an insect. It is these spores mainly with which we have to contend. For, although the fungus forms another sort of spore, the latter is produced in much smaller numbers and does not immediately develop into a plant. The spores described above (known technically as "zoospores," from their animal-like habit of swimming about) are the sort which, from their number, rapidity of growth and motility, enable the plant to develop in enormous numbers and to become widely disseminated during a single season.

The fact that these zoospores are not covered by any sort of protecting skin or membrane gave rise to a hope that they might be destroyed to a greater or less extent by the addition of a disinfecting or germicidal substance to the water containing them. The choice of disinfectant was naturally limited to substances which would not injure the fish. It seemed, on the whole, best to try the effect of "electrozone," an exceedingly powerful germicide formed by the passage of an electric current through salt water. Electrozone can be swallowed without danger and seemed likely to be the best disinfectant to add to the water.

The first step in the experiment was to determine what proportion of electrozone the water must contain in order to stop the development of the fungus. To

this end a series of test tubes plugged with cotton were thoroughly sterilized by baking. Then into each test tube was poured a certain amount of distilled water. To the water in each tube was then added variable amounts of electrozone. For example, the first tube contained 10 cubic centimeters (about 250 drops) of water and 1 drop of electrozone; the second tube, 25 cubic centimeters (625 drops) of water and 1 drop of electrozone, the third, 30 cubic centimeters (750 drops) of water and 1 drop of electrozone; the next two each contained 50 cubic centimeters (1,250 drops) of water with 1 drop of electrozone; and the last two each 100 cubic centimeters (2,500 drops) of water and 1 drop of electrozone. Into each test tube was then dropped a large fly (upon whose body the fungus rapidly grows). Each fly had previously been thoroughly rubbed upon the fungus-covered body of one of the trout brought from the creek the day before. The test tubes were then left for twenty-four hours, at the end of which time the fungus growth could be seen upon the bodies of all of the flies except those in the tubes containing 10 cubic centimeters of water with 1 drop of electrozone and 25 cubic centimeters of water with 1 drop of electrozone. At the end of forty-eight hours the fungus had developed in the second of these tubes. The outcome of these experiments is, then, that to prevent the growth of the fungus the ratio of electrozone to water must be 1 drop of the former to 250 drops (10 cubic centimeters) of the latter. It is to be regretted that other tubes containing 1 drop of electrozone to 15 cubic centimeters (375 drops) of water and 1 drop of electrozone to 20 cubic centimeters (500 drops) of water were not prepared, for it seems quite probable that further tests will show that a smaller amount than one part of electrozone to 250 parts of water will suffice. However, without waiting to learn the outcome of such experiments it seems best, the case being so urgent, to proceed at

once to the hatchery and try the effect of electrozone on the fish. It may interfere seriously with their breathing, but nothing besides a trial will determine. In case they can endure the addition of the disinfectant, the next step will be to devise a practical method for the regular and gradual addition of the disinfectant to the running water. If this method of treatment be adopted it will have to be carried on until the fungus spores have nearly all been carried out of the creek. It is not expected of course entirely to rid the creek water of the fungus. At most it will be possible only to kill off the superabundance of spores.

Very truly yours,

CHARLES WRIGHT DODGE.

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#### DISCUSSION ON THE PAPER OF MR. CHARLES WRIGHT DODGE.

Mr. Amsden spoke of the matter that had come up recently as to an epidemic among the trout in Spring Creek, which furnishes the water for the State ponds. It is a mile long and furnishes the water for the Hatcheries at Caledonia. This is a remarkable stream, as it has a temperature all the year round of 45 to 50 degrees, and abounds with lake trout, and of late years the German trout have been put in from the Hatcheries, and everything has gone along for years without any trouble except about eight years ago. At the head of this stream is a pond of about ten acres, which furnishes the power for a grist and saw mill. When the water gets low it has been the habit for years to store the water during the night, and the next day the bottom of the pond in some places is exposed. About eight years ago the owners of the mill took a notion they would kill the weeds in the bottom of the

stream, and the result was that it brought down a mass of decayed vegetation, which killed in the neighborhood of 1,000 trout. Since then we have had no trouble until last week, when a few fish were found dead, and the next day the number of dead fish had increased, and the man who discovered them went to the head of the stream and found it entirely depopulated and the fish all gone, and it has since been ascertained that the fish went down the creek where they could get water that did not pass through this pond, but the other fish were dying rapidly. Upon examining the dead fish a fungus growth was discovered, which was also found upon all the others.

Mr. Bowman spoke as follows:—

"I have had some experience in Caledonia brook, and I never found one instance where there was an epidemic. It is a stream of remarkably pure water, and I dislike very much to have it advertised that there is any epidemic, and I think it occurs from the fact of the mill located at the head of the stream and the drying out of the water when the weather was hot, then being filled up very slowly with the water at 80 degrees. This killed the fish and caused the fungus to grow. It is difficult to say what causes fungus, and I do not think there is any fungus in Caledonia creek that a proper dose of salting will not cure. If a fish in fresh water has fungus you take it and put it into salt water, and vice versa, it will cure the fungus. If several barrels of salt water had been poured into the creek it would likewise have caused the growth to disappear. If you find fungus, dump plenty of salt in; it is the cheapest remedy you can find and the best.

"There ought to be no epidemic in Caledonia creek. I was there fishing not more than a mile from the head. I found no evidence of any sick fish, nor any evidence of fungus, and the fish rose to a fly, but a sick fish won't

rise to a fly, and I caught them. I believe it came from the cause I spoke of. It is an important fact for all men who have anything to do with trout to understand the fact of salting fish, and giving them plenty of it, and this is based on my experience and that of my friends, and some of them have had twenty-five years' experience with this remedy of salt."

Mr. Ford then said: "In the hatchery at Allentown, whenever fungus appears on the fish, salt has been tried on them. We cure the fish by transferring them to tanks filled with salt water. Some gold fish were taken out of an aquarium filled with fresh water that had shown signs of fungus and put into an aquarium filled with salt water. This remedy was a success, and it is one that is available."

Mr. Mather said:

"I would say in reference to Mr. Bowman's remarks about salt for curing the fungus that it holds good if the fungus has not gone too far. If the fungus has grown through the outer skin and fastened its roots under the skin, I do not believe there is anything that will save that fish."

Dr. James:—

"The principle of any disease—for instance, consumption, in its early stages, is the same. If you apply the remedy before it has become rooted in the system it will cure the disease, but after a certain stage of the malady, complications arise, and thus it is with the fish. After the disease has penetrated into the lower structures of course the fish will die, but nevertheless salt is a good remedy."



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- ✓ Borodine, Nicolas, Delegate of the Russian Association of Pisciculture and Fisheries, Uralsk, Russia.
- ✓ Jones, John D., 51 Wall St., New York City.
- ✓ Southside Sportmens' Club, Oakdale, Long Island.
- ✓ New York Association for the Protection of Fish and Game, New York City.
- ✓ St. Clair Flats Shooting and Fishing Club, Detroit, Mich.
- ✓ Woodmont Rod and Gun Club, Washington, D. C.
- ✓ Fish Protective Association of Eastern Pennsylvania, 1020 Arch St., Philadelphia, Pa.

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- Macleay, William, President of the Fisheries Commission of New South Wales, Sydney, N. S. W.
- Maitland, Sir Jas. Ramsay Gibson, Bart., Howietoun, Stirling, Scotland.
- Malmgren, Prof. A. J., Helsingfors, Finland.
- Marston, R. B., Esq., Editor of the Fishing Gazette, London, England.
- Olsen, O. T., Grimsby, England.
- Sars, Prof. G. O., Government Inspector of Fisheries, Christiania, Norway.
- Smitt, Prof. F. A., Stockholm, Sweden.
- Sola, Don Francisco Garcia, Secretary of the Spanish Fisheries Society, Madrid, Spain.
- Solsky, Baron N. de., Director of the Imperial Agricultural Museum, St. Petersburg, Russia.
- Trybom, Dr. Filip, Stockholm, Sweden.
- Walpole, Hon. Spencer, Governor of the Isle of Man.
- Wattel, M. Raveret, Secretary of the Société d' Acclimatation, Paris, France.
- Young, Archibald, Esq., Inspector of Salmon Fisheries, Edinburgh, Scotland.

## Active Members.

- Adams, Dr. S. C., Peoria, Ills.
- Adams, E. W., 114 Wall St., New York City.
- Adirondack Reserve Association, (James Yealden, Treas.) 11 Pine St., New York City.
- Agnew, John T., 284 Front St., New York City. *asks to resign.*
- Alexander, \* L. D., Stock Exchange, New York City.
- Amsden, Frank J., Rochester, N. Y.
- Anderson, J. F., 240 11th St., New York City. *Address not known.*
- Anderson, A. A., Bloomsburg, N. J.
- Annin, Jr., James, Caledonia, N. Y.
- Armstrong, C. F., Toledo, Ohio.
- Atkins, Chas. G., East Orland, Me.
- Ayer, F. W., Bangor, Me.
- Babcock, C. H., Rochester, N. Y. *Fish Commr.*
- Balkam, Wm. F., Rochester, N. Y.
- Banks, Charles, 453 Fifth Avenue, New York City. *Cannot be found.*
- Banks, R. Lenox, Albany, N. Y.
- Barnum, Wm., Rochester, N. Y. *Can not find*
- Bartlett, Dr. S. P., Quincy, Ills.
- Bean, Dr. Tarleton H., Battery Park Aquarium, New York City.
- Belmont, Perry, 19 Nassau St., New York City.
- Benkard, James, New York City. *Cannot be found.*
- Bickmore, Prof. A. S., American Mus. Nat. Hist., New York City.
- Bishop, Dr. Heber, 380 Newberry St., Boston, Mass.
- Bissell, J. H., Detroit, Mich.
- Blackford, Eugene G., 80 Fulton Market, New York City.
- Blair, J. H., Omaha, Neb. *Never was a member to his knowledge.*
- Booth, A., Cor. Lake and State Sts., Chicago, Ills.
- Bottemanne, C. J., Bergen op Zoom, Holland.
- Bower, Seymour, 234 Joseph ~~Chapman~~ Ave., Detroit, Mich. *Campan/*
- Bowman, W. H., Rochester, N. Y.
- Bradley, Dr. E., 19<sup>W</sup> 30th St., New York City.
- Brown, F. W., Cor. Broad and Cherry Sts., Philadelphia, Pa.
- Brown, John E., U. S. Fish Commission, Washington, D. C.
- Brown, S. C., U. S. National Museum, Washington, D. C.

\* Resigns after 1895.

- Bryan, Ed. C., Washington, D. C.
- Bryson, Col. M. A., New York City. *Can not be found.*
- Bull, H. S., 73 State St., Albany, N. Y. *Says he resigned, 1891*
- Buller, N. R., Carolina, R. I.
- Bush, Dr. E. F., Mount Vernon, N. Y.
- Butler, Frank A., 291 Broadway, New York City.
- Butler, W. H., 291 Broadway, New York City.
- Carpenter Brook Fishing Club, Syracuse, N. Y. *This should be R. W. Jones, Jr.*
- Cary, Dr. H. H., Lagrange, Ga.
- Chamberlayne, C. F., Buzzards Bay, Mass.
- Cheney, A. N., Glens Falls, N. Y.
- Clapham, Thos., Roslyn, Long Island.
- Clapp, A. T., Sunbury, Pa.
- Clark, A. Howard, U. S. National Museum, Washington, D. C.
- Clark, Frank N., Northville, Mich.
- Clark, W. Campbell, Newark, N. J.
- Collins, J. Penrose, 850 Drexel Building, Philadelphia, Pa. *Request acceptance of resignation*
- Collins, Jos. W., Laurel, Md
- Comstock, Oscar, Fulton Market, New York City.
- Conklin, W. A., 5 Catherine St., New York City.
- Corwin, D. P., 413 Wood St., Pittsburg, Pa.
- Crook, Abel, 99 Nassau St., New York City
- Crosby, Henry F., P. O. Box 3714, New York City.
- Cox, W. V., U. S. National Museum, Washington, D. C.
- Dale, Dr. Jas. A., York, Pa.
- Davis, B. H., Palmyra, N. Y.
- ~~Will~~ Davis, H. W., Grand Rapids, Mich. *1262 So' Division St.*
- Dean, Dr. Bashford, Columbia College, New York City.
- Dean, H. D., U. S. Fish Commission, Cape Vincent, N. Y.
- Demuth, H. C., 114 East King St., Lancaster, Pa.
- Dewey, J. N., Toledo, O.
- Donaldson, Thomas, Philadelphia, Pa.
- Douredoure, B. L., 103 Walnut St., Philadelphia, Pa.
- Downs, H. D., Birmingham, Conn. *Returned Feb. 7, 1896.*
- Doyle, Edward P., Port Richmond, Staten Island, N. Y.
- Dunning, Hon. Philo., Madison, Wis.
- Earll, R. E., U. S. National Museum, Washington, D. C. *Dead*

- Ebel, Hon. F. W., Harrisburg Pa.
- Ellis, J. F., U. S. Fish Commission, Washington, D. C.
- Fairbank, N. K., Chicago, Ills. *Says he resigned when removed from Ill. Fish Comm.*
- Fitzhugh, D. H., Bay City, Mich.
- Foord, John., Civil Service Commission, New York City. *19 Beaver*
- Ford, H. C., 1823 Vine St., Philadelphia, Pa.
- Foulds, Dr. T. H., Glens Falls, N. Y.
- French, Asa B., South Braintree, Mass.
- Friesmuth, Jr., E. N., 151 North 3d St., Philadelphia, Pa.
- Frothingham, H. P., Mount Arlington, N. J.
- Garman, Samuel, Mus. Comp. Zool., Cambridge, Mass.
- Gavitt, W. S., Lyons, N. Y.
- Gay, John, 1020 Arch St., Philadelphia, Pa.
- Gilbert, W. L., Plymouth, Mass.
- Goode, G. Brown, U. S. National Museum, Washington, D. C. *Asks to resign*
- Green, M. A., Rochester, N. Y.
- Griffith, C. E., Port Richmond, Staten Island, N. Y.
- Gunkel, J. E., Toledo, O.
- Habershaw, Fred., New York City. *Cannot find him.*
- Hackney, D. G., Fort Plain, N. Y.
- Hagert, Edwin, 32 6th St., Philadelphia, Pa.
- Hale, A. G., Reeds Creek, N. Y.
- Haley, Albert, <sup>6</sup>Fulton Market, New York City. *Asks to resign.*
- Haley, Caleb, <sup>14</sup>Fulton Market, New York City.
- Hall, G. W.
- Hamilton, Robert, Greenwich, N. Y.
- Hansen, G., Osceola, Wis.
- Harris, J. N., <sup>3</sup>Fulton Market, New York City.
- Harris, Gwynne, Washington, D. C.
- Harris, W. C., American Angler, 19 Park Place, New York City.
- Hartley, R. M., 627 Walnut St., Philadelphia, Pa.
- Hasbrouck, C. T., Cleveland, O. *Says he resigned in 1893.*
- Hayes, A. A.
- Hazel, Edwin.
- Henshall, Dr. J. A., Cincinnati, O. & Tampa, Fla.
- Hergesheimer, W. S., 2145 N. 22d St., Philadelphia, Pa.
- Hessel, Rudolph, 1209 H St., N. W., Washington, D. C.

- ✓ Hill, M. B., Clayton, N. Y.
- ✓ Hill, W. J.
- ✓ Hinchman, C. C., Detroit, Mich.
- ✓ Hofer, J. C., Bellaire, O.
- ✓ Hoxie, J. W., Carolina, R. I.
- ✓ Hughes, T. W. B., 258 Broadway, New York City.
- ✓ Humphreys, Dr. E. W., Salisbury Md.
- ✓ Huntington, L. D., New Rochelle, N. Y.
- ✓ Huntington, W. R., Cleveland, Ohio.
- ✓ Hurlbut, H. F., 5 Lincoln St., Lynn, Mass.
- ✓ Hutchinson, Chas., Utica, N. Y.
- ✓ Hutchinson, E. S., Washington, D. C.
- ✓ Hyneman, A. A., 55 W. 33d. St., New York City.
- ✓ Imbrie, Chas. F., 18 Vesey St., New York City. *Wishes to resign after 1895*
- ✓ Isaacs, M., Stock Exchange, New York City,
- ✓ James, Dr. B. W., N. E. Cor. 18th and Greene Sts., Philadelphia, Pa.
- ✓ Jennings, G. E., 317 Broadway, New York City.
- ✓ Jessup, F. J., 88 Cortlandt St., New York City.
- ✓ Johnston, S. M., <sup>Union</sup>~~Battery~~ Wharf, Boston, Mass.
- ✓ Jones, Alexander, Woods Hole, Mass.
- ✓ Jones, Dr. O. L., 116 W. 72d. St., New York City.
- Send to Club only { ✓ Jones, R. W., Syracuse, N. Y. *Pres. Carpenter Brook Fishg. Club.*
- ✓ Kauffman, S. H., *Evening Star*, Washington, D. C.
- ✓ Keene, J. H., Greenwich, N. Y.
- ✓ Kelly, P., 346 6th Ave., New York City.
- ✓ Kimball, R. J. New York City. *16 Broad*
- ✓ Klock, G. S., Rome, N. Y.
- ✓ Lawrence, F. C., Union Club, New York City. *Cannot find*
- ✓ Leavenworth, C. W., Wilkes-Barre, Pa.
- ✓ Long, J. Verner, University Club, Pittsburg, Pa. *Says he resigns*
- ✓ Loring, J. A., 3 Pemberton Square, Boston, Mass.
- ✓ Lydecker, Major G. I., U. S. Engineers, Washington, D. C. *Not found*
- ✓ Lyman, H. H., Oswego, N. Y.
- ✓ McDonald, \*Marshall, U.S. Fish Commissioner, Washington, D.C.
- ✓ McGown, H. P., 76 Nassau St., New York City. *108 Fulton*
- ✓ Mackay, R. M., 1517 N. 14th St., Philadelphia, Pa.

\* Died Sept. 1, 1895.

- Mallory, Chas., Foot Burling Slip, New York City.
- Manning, W. W., Marquette, Mich.
- Mansfield, Lt. H. B., U. S. Navy Yard, Brooklyn, N. Y.
- Marks, W. D., Caledonia, N. Y.
- Mather, Fred., Cold Spring Harbor, N. Y. *63 Linden St., Brooklyn*
- May, W. L., Omaha, Neb.
- A. Mayer, ~~H.~~ M., *Is not a member.*
- Meehan, W. E., Public Ledger, Philadelphia, Pa.
- Merrill, F. J., Albany, N. Y.
- Middleton, W.<sup>70</sup>, Fulton Market, New York City.
- Milbank, S. W., Union Club, New York City. *1 West 21st St.*
- Miles, J. F., 1820 Arch St., Philadelphia, Pa.
- Miller, E., Fulton Market, New York City.
- Miller, J. O., Mt. Kisco, N. Y.
- Miller, S. B.<sup>7</sup>, Fulton Market, New York City.
- Mills, G. T., Carson City, Nevada.
- Mitchell, A., Norwich, Conn.
- Mohican Rod and Gun Club, Glens Falls, N. Y.
- Moon, G. T.<sup>7</sup>, Fulton Wholesale Fish Market, New York City.
- Moore, G. H. H., Washington, D. C. *Says he notified Sec. 2 yrs. ago, is not a member.*
- Morrell, Daniel, Hartford, Conn.
- Nevins, James, Madison, Wis.
- O'Brien, M. E., ~~South Bend, Neb.~~ *St. Louis, Mo., Supt. Mo. F. C.*
- Offensend, J. H., Fair Haven, Vt.
- O'Hage, Dr. Justus, St. Paul, Minn.
- Orvis, Chas. F., Manchester, Vt.
- Osborn, C. V., Dayton, O.
- Page, George, 49 Wall St., New York City. *Cannot be found.*
- Page, Parker W., West Summit, N. J.
- Page, Wm. F., Neosho, Mo.
- Palmer, G. H.
- Parker, Dr. Joel C., Grand Rapids, Mich.
- Parker, Jr., Peter, South Framingham, Mass.
- Peabody, G. F., Appleton, Wis.
- Pease, Charles, East Rockport, O. *Dead*
- Pfeiffer, Jr., Geo., Camden, N. J.
- Porter, B. P., Colton, Cal. *Has not been a member for years.*

- Rathbone, Esq., Wm. F. Del. & H. Canal Co., Albany

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- Post, Hoyt, Detroit, Mich.
- Powell, W. L., Harrisburg, Pa.
- Powers, J. A., Lansingburg, N. Y.
- Preston, Dr. H. G., 98 Lafayette Square, Brooklyn, N. Y.
- Quackenbos, \* J. D., 331 W. 28th St., New York City.
- Rathbun, Richard, U. S. Fish Commission, Washington, D. C.
- Ravenel, W. de C., U. S. Fish Commission, Washington, D. C.
- Reinecke, T., New York City. *Cannot be found.*
- Reynal, J., New York City. *Cannot be found.*
- Reynolds, C. B., 318 Broadway, New York City.
- Ricardo, Geo., ~~Hackensack, N. J.~~ *195 Water St., New York.*
- Robeson, G. M., Trenton, N. J.
- Rogers, \* H. M., Fulton Market, New York City.
- Rowinville, E. T., East Freetown, Mass.
- Rufmayer, L. M.
- Saranac Lake Hotel Co., Ampersand, N. Y.
- Schaffer, G. H., New York City. *Foot Perry St. h. 286 Carroll*
- Schuermann, C. W., Smithsonian Inst., Washington, D. C. *Brooklyn*
- Schuyler, H. P. *Schenectady, N. Y.*
- Sherwin, H. A., 100 Canal St., Cleveland, O.
- Simmons, Newton.
- Smiley, C. W., 943 Mass. Ave., N. W., Washington, D. C.
- Smith, Dr. H. M., U. S. Fish Commission, Washington, L. C.
- Spangler, A. M., 529 Commerce St., Philadelphia, Pa.
- Spensley, Calvert, Mineral Point, Wis.
- Spofford, H. W.
- Stelwagen, W., Philadelphia, Pa.
- Stone, Livingston, Baird, Shasta Co., Cal.
- Stone, S. R., 58 Pine St., New York City.
- Stranahan, J. J., Put-in Bay, Ohio.
- Streuber, L., Erie, Pa.
- Sweeny, Dr. R. O., Duluth, Minn. *Lester Park.*
- Taylor, Jr., Alexander, Mamaroneck, N. Y.
- Thompson, E., Northport, Long Island, N. Y.
- Titcomb, J. W., St. Johnsbury, Vt.
- Tomlin, W. D., Duluth, Minn.

\* Resigns after 1895.



- Upton, G. W., Warren, O.
- Van Brunt, C., South St., New York City. *Cannot find him.*
- Van Cleef, J. S., Poughkeepsie, N. Y.
- Van Valkenberg, B. F., 288 Greenwich St., New York City.
- Wallace, N., Farmington, Conn. *wishes to resign after 1895.*
- Walton, C. W., 1713 Spring Garden St., Philadelphia, Pa.
- Webb, W. Seward, 44th St. and Vanderbilt Ave., New York City.
- Weed, W. R., Potsdam, N. Y.
- Weeks, Seth E., Bloomington, Ind.
- Welshons, G. D., Pittsburg, Pa.
- Whitaker, E. G., 29 Broadway, New York City.
- Whitaker, Herschel, Detroit, Mich.
- Wilbur, E. R., 318 Broadway, New York City.
- Wilbur, H. O., 3d, below Pine St., Philadelphia, Pa.
- Wilcox, Joseph, Media, Pa.
- Wilcox, W. A., U. S. Fish Commission, Washington, D. C. *wishes to be dropped*
- Willetts, J. C., 49 Wall St., New York City.
- Williams, A. C., Chagrin Falls, O.
- Wilmot, Samuel, Ottawa, Canada.
- Wilson, J. Paul, Washington, D. C.
- Witherbee, W. C., Port Henry, N. Y.
- Wood, Benjamin, Park Place, New York City. *Requests to resign after 1895.*
- Woodruff, G. D., Sherman, Conn.
- Worth, S. G., U. S. Fish Commission, Washington, D. C.
- Zweighthaft, S., ~~1323 Franklin St., Philadelphia, Pa.~~ *104 W. 71, New York.*

*First lot mailed Jan. 31, 1896.*

*Last lot mailed Feb. 4, 1896.*

*J. H. B.*

*Final notices of meeting mailed  
Apr. 24 and 25, 1896.*